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With a frontage of 342 ft. on Pennsylvania avenue, and a depth of 565 ft., the four-storied granite structure of the State, War and Navy Department ranks as the largest and most magnificent office building in the world. It has 500 rooms and two miles of marble halls. The stairways are of granite with balusters of bronze, and the entire construction is fireproof, for the records and archives deposited within its walls are priceless and beyond restoration.

The War Department occupies the west wing, the Navy Department the east wing, and the State Department the south. The main entrance to all of these is on the Pennsylvania avenue front. The offices of the Secretaries, on the second floor, are accessible only for business, but the richly furnished ante-rooms may be inspected.

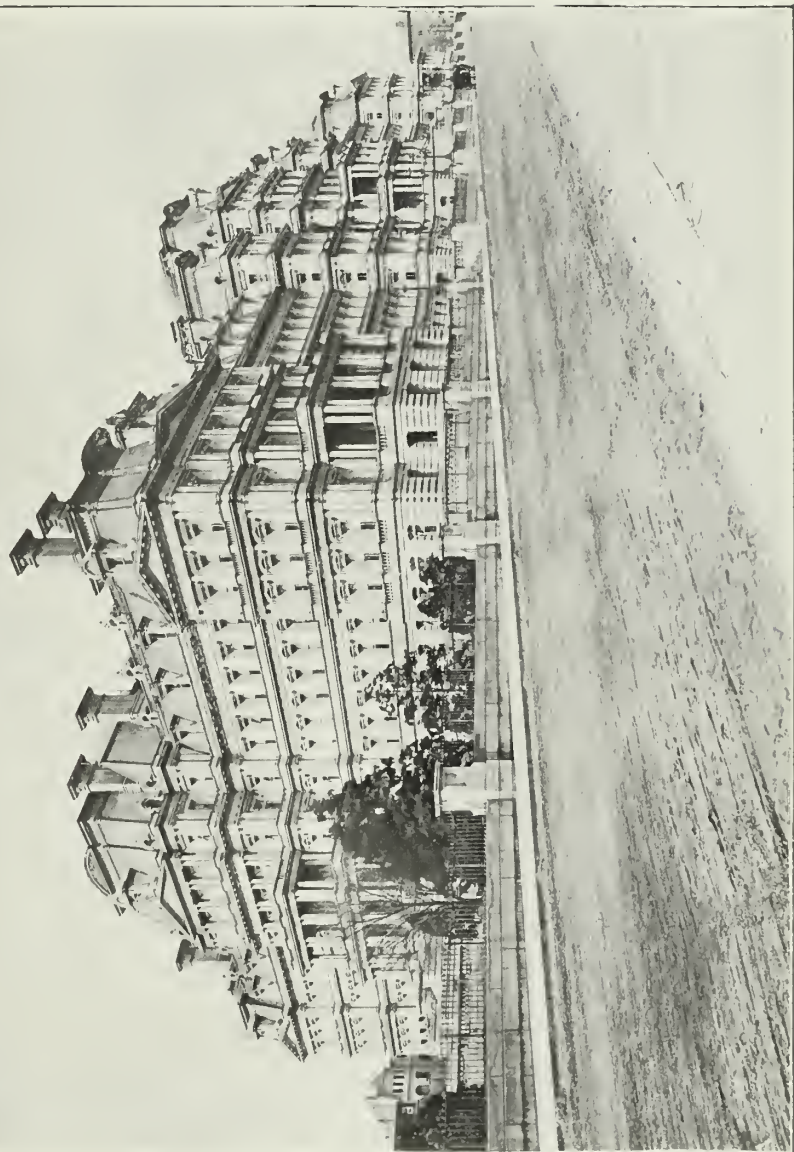
In the ante-room of the office of the Secretary of the Navy may be seen portraits of former Secretaries; the series is incomplete. In the corridor are models of war vessels. The Naval Library is on the fourth floor.

The silver set, presented by citizens of Philadelphia, 1812, to Capt. Isaac Hull, commander of the American frigate *Constitution*, in commemoration of his victory of Aug. 19, 1812, when he destroyed the British man-of-war *Guerriere*, is shown; also a brace of pistols and a sword, presented to him by Connecticut for a similar memorial. The American frigate *Constitution* ("Old Ironsides") was built at Boston in 1797. At the beginning of the War of 1812, she was commanded by Capt. Isaac Hull. On Aug. 19, 1812, she engaged the *Guerriere* in a close fight. The British ship surrendered and was burned. This was the first naval action of the war. For his gallantry Congress presented Hull with a gold medal. When in 1830 it was proposed to break up the *Constitution*, public opposition was so intense that the step was abandoned. It was then that Holmes wrote, "Ay! tear her tattered ensign down." The "*Constitution*" is now receiving ship at the Portsmouth Navy Yard.

Medals awarded by acts of Congress to officers of the Army and Navy for distinguished services are also on exhibition.

Swords presented to the United States by Japan with treaties; medals in commemoration of the first Japanese Embassy to the United States; also a whale's tooth sent to the United States as a treaty by the King of the Fiji Islands.

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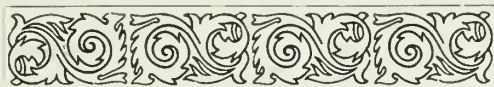
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INTRODUCTION.

IN presenting the fourth issue of the Official Manual and Constitution Book of the Ordnance Relief Association, we are pleased to call the attention of our readers to a mass of interesting and valuable matter relating to the New Battleships, Cruisers and Torpedo Craft, now building and in commission with graphic illustrations of the same; also the Torpedo in Peace and War, Submarine Mines, Etc.

In addition to all this are given a History of the Association, its Constitution, By-Laws and List of Members, together with half-tone photo-engravings of the latter—and of men prominent in the Navy Department, Bureau of Ordnance, Etc., as well as views of the Naval Training Schools, at Mare Island, Cal. and at Newport, R. I.

It is the purpose of the Committee having in charge the publication of this Annual Manual to make it interesting and valuable to the reader and advertiser alike, by placing therein live and fresh matter in each succeeding issue, which will bear directly upon the most salient features of our Navy—the vessels building and in commission—their type, speed, Etc. and the new features from time to time embodied in the same.

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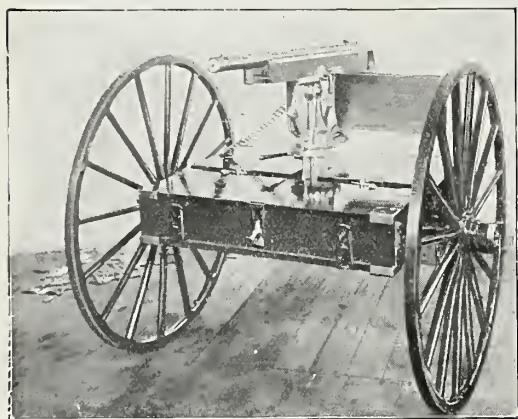
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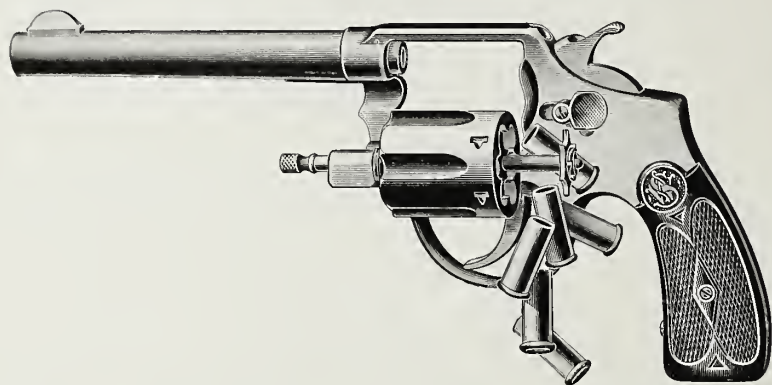


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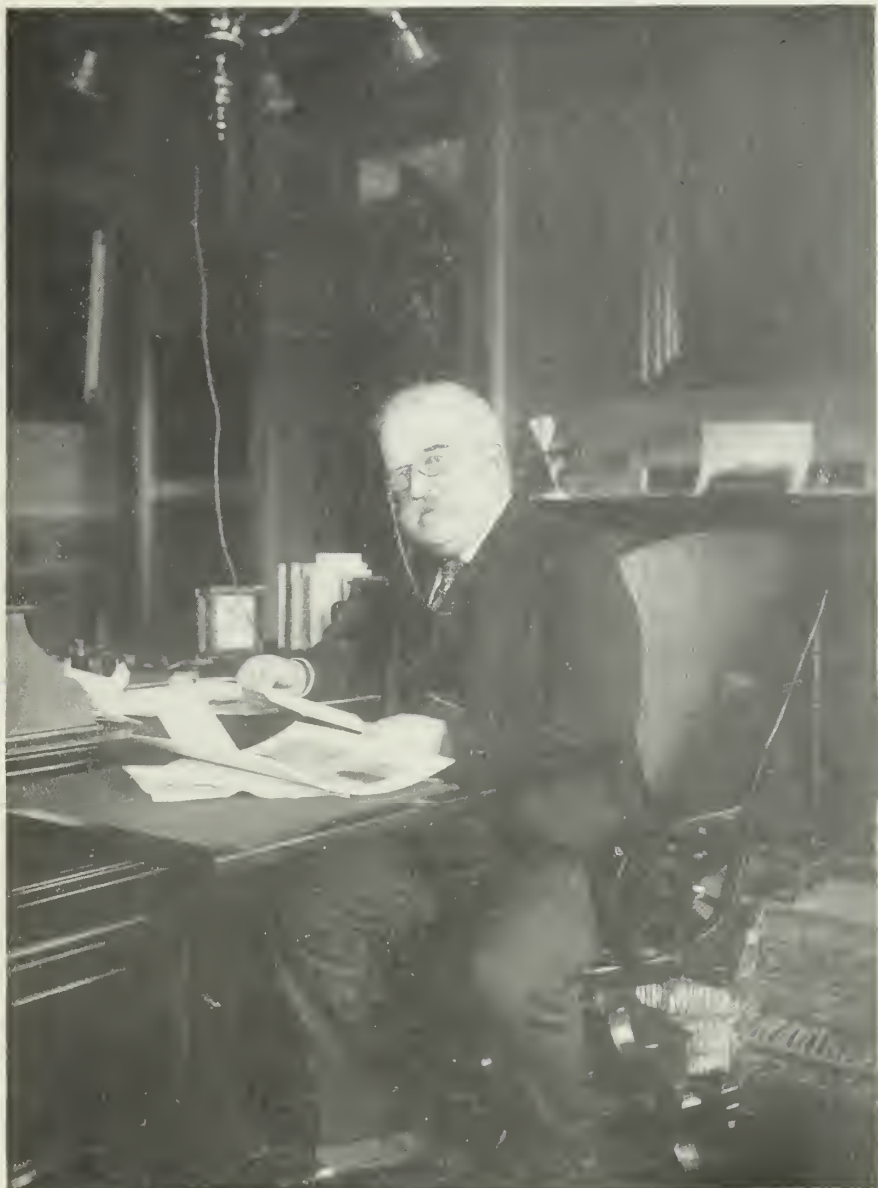
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For years it was the custom among the employes of the Washington Gun Factory to aid those needing assistance in times of affliction by voluntary subscriptions being taken in the various shops, and the proceeds of such subscription given into the hands of the one to be assisted. It was discovered that in many cases the sum realized was not sufficient to render any material aid, and in other cases more money was subscribed than the case required. This method of relief, after years of trial, became very unsatisfactory. The subscription lists increased in number as each pay-day rolled around, and the burden fell heavily upon those who at times could ill afford to join their comrades in relieving distress in this manner.

To meet and overcome this unfavorable condition, it was decided by a number of prominent men in the shops to call a meeting of the employes for the purpose of devising some plan for offering relief on a business basis.

Organization.

A meeting was held on November 15th, 1891, and, after deciding to form the Ordnance Relief Association, the following gentlemen were elected officers for the current year:

President, Joseph H. Lawrence, M. M.

Vice-President, Joseph Webb.

Recording Secretary, Abram Welty.

Financial Secretary, T. M. Hayes.

Treasurer, W. M. Mathis.

Plan.

The plan adopted is similar to that so successfully in operation at the Government Printing Office for many years—to grant to sick or disabled members, the sum of one (\$1.00) dollar for each work day for a period of six weeks only in one year, said benefit not to be paid for a shorter time than six days, the dues to be fifty (50c.) cents per month. At the end of each year all money remaining in the treasury to be divided pro rata among the members who have not drawn benefits during the year. The affairs of the Association to be administered by an Executive Committee composed of the officers and seven members of the Association, appointed annually by the President, to whom all applications for membership, relief and other matters shall be submitted.

The Constitution.

The Constitution was adopted practically as printed in this volume, with the exception of such amendments as have been adopted from time to time, as the growth of the Association seemed to require for the proper transaction of its business.

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and length.

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The Association a Success.

The first year, ending December 31, 1892, showed a membership of 167.

Amount of dues paid.....	\$946.50
Number of members relieved.....	46
Amount paid in sick benefits.....	\$384.00

Balance in treasury divided, giving each member a dividend of \$2.31. A statement is herewith submitted, showing the business of the Association for each year since its organization.

Present Membership.

No advantage can be derived from an increase in numbers, as it is well understood the percentage of sickness is greater in a large membership, say, 500, than it would be among 300. Consequently, it is solely for the purpose of having every employe of the Naval Gun Factory protected that we urge them to unite with the Association.

At the January, 1898, meeting an amendment to the Constitution was adopted creating a Mortuary or Death Benefit Fund, the object of which is to give immediate relief to the families of deceased members. Membership in this feature of the Association is optional; but its advantages to many of our number cannot be over-estimated, and should induce every member of the Association to at once enroll themselves members of this immediate relief fund.

The success of this Association has been far beyond the hopes of its founders, and it is commended to all large bodies of men employed in the same locality as the most economical and effective means of rendering assistance to those who may be overtaken by misfortune.

The following table exhibits by years the membership, sick benefits and pro rata dividend paid since the organization of the Association:

	1891	1892	1893	1894	1895	1896	1897	1898	1899
No. of members close of year.	126	167	168	219	207	208	245	353	495
Total amt. paid for sick benefits	384	514	710	746	645	661	574	528	1,596
No. of weeks benefits paid. . . .	64	86	118	124	108	110	96	88	266
No. of members receiving benefits	56	46	65	71	54	53	45	60	125
Pro rata dividend at close of year	246	231	190	321	319	280	381	396	324



Order of Business.

1. Roll call of Officers.
2. Reading of minutes.
3. Reports of Secretaries and Treasurer.
4. Reports of Standing and Special Committees.
5. Report of Executive Committee.
6. Unfinished business.
7. Receiving communications and bills.
8. New business.
9. Election and installation of officers
10. Good and welfare of the association.

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COMMODORE GEORGE W. MELVILLE.
Engineer-in-Chief, U. S. N.

Chief Naval Constructor Philip Hichborn, United States Navy.

Chief Naval Constructor Philip Hichborn, U. S. Navy, was born in Charlestown, Mass., on the fourth day of March, 1839. In 1855 he was graduated from the Boston high school, the now Hon. Samuel Pasco, Senator from Florida, and Mr. Hichborn being the only boys in the class.

From the Boston high school Mr. Hichborn was indentured to the government under the tuition of the late Melvin Simmons, U. S. N., then master shipwright of the Boston Navy Yard. While under instruction and in recognition of his merit, Secretary Toucy, then Secretary of the Navy, ordered that Hichborn receive a course of theoretical training. This two years' course was fruitful in remarkable progress in ship designing and calculations. Through this steady application to the theoretical and practical phases of his profession, Mr. Hichborn reached, at an unusually early age, a degree of proficiency rarely attained.

In July of 1860 Melvin Simmons was appointed Naval Constructor and immediately ordered to the navy yard, Mare Island, California. A little over a month later Mr. Hichborn, then twenty-one years old, left Boston in the clipper ship Dashing Wave for California, serving in the capacity of one of the ship's officers. From work in connection with the Pacific Mail Company Mr. Hichborn soon entered the employment of the Government at the navy yard, Mare Island, and rose in two years to the position of master shipwright of the station, a position that often involved the direction of large numbers of men, and the complete control of the construction department of the yard during the absence of the naval constructor. In 1864 he was tendered the appointment as assistant naval constructor, but declined the honor, as the salary allowed was much less than he received as master shipwright. In 1869, however, he made application for an appointment and in May of the same year passed a severe examination and was duly appointed on June 26 as an assistant naval constructor, U. S. N., with the relative rank of Lieutenant. Mr. Hichborn's California days are full of bright and picturesque reminiscences of those early times in the history of that golden state, and to those old Californians who knew him and who served with him and under him, no name is dearer than his, and no affection warmer than the lasting regard with which he is remembered.

From California he was ordered to the navy yard, Portsmouth, N. H., in 1870. The five years spent at that station were full of hard work, and many were the trying demands upon his ability. In 1875, after an unusual competitive examination, he received his commission as a naval constructor, marked No. 1. In the latter part of 1875, Mr. Hichborn was detached from the Navy Yard, Portsmouth, and ordered to League Island, Pennsylvania. At that time the old yard was being abandoned and the machinery, stores, ship-houses, etc., were being transported to the new yard, League Island. The larger part of this important work devolved upon the naval constructor as the representative of the construction plant of the yard. In 1876 he also took a prominent and important part in the Centennial Exhibition. In June, 1884, he was selected by the Secretary of the Navy for special duty in Europe. His report upon European dockyards embodies the result of his investigations. This work has become a text book among the profession. Upon its first appearance much concern was manifested by foreign powers, for nothing so exhaustive or conclusive had been published or obtained before.

Besides his professional and executive ability, Mr. Hichborn has a strong inventive turn of mind.

A life of valuable usefulness has invariably characterized Mr. Hichborn's career. Truly may it be said that he is a self-made man, and has risen by his own exertions to the position of Chief Naval Constructor of the U. S. Navy, and in so far as we can learn, has pushed no one aside to reach his present high and responsible position.



REAR-ADMIRAL PHILIP HIGBORN.
Chief Constructor, U. S. N.

COMPLIMENTS OF

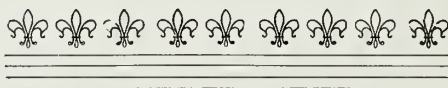
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Rear Admiral Charles O'Neil.

Chief of Bureau of Ordnance.

Rear Admiral O'Neil was born in England in 1842, and entered the U. S. Navy, as Master's Mate, in July, 1861, on board the sloop "Cumberland," and was attached to that vessel at the capture of Forts Hatteras and Clark, August, 1861, and in the engagement with the Confederate iron-clad "Merrimac," March 8, 1862.

He rescued Lieutenant Morris from drowning, and being favorably mentioned, was promoted to Acting Master, May 1, 1862; attached to the gun-boat "Tioga," during latter part of 1862 to July, 1864; cruised in Wilkes' Special West India Squadron, and East Gulf Blockading Squadron; steamer "Rhode Island," North Atlantic Blockading Squadron, 1864-5; in both attacks on Fort Fisher and was favorably mentioned for the same.

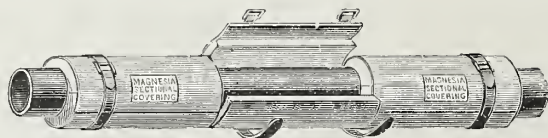
He was promoted to Acting Volunteer Lieutenant, May 30, 1865; on receiving ship "Princeton" at Philadelphia, part of 1865-6; on steam gunboat "Shamrock," European Squadron, part of 1866-7. Visited West Coast of Africa, islands in the Atlantic, Spain, France and Italy; and on storeship "Guard," European Squadron, part of 1867-8.

He was commissioned as Lieutenant, March 11, 1868, and promoted to Lieutenant-Commander, Dec. 18, 1868; assigned to receiving ship "Ohio," Boston, 1869; made aide to Port Admiral Hiram Paulding, at Boston, 1870; on ironclad "Dictator," North Atlantic Squadron, 1870-1; on receiving ship "Boston," 1872; on "Wasp" (fourth rate), South Atlantic Squadron, 1873-6; on training ship "Minnesota," 1876-7; Commander of "Supply" (fourth rate), 1877, and of "Swatara," Asiatic Station, 1877-9; assigned to special ordnance duty, 1884-6.

He was promoted to Commander, July, 1884; assigned to Ordnance duty at the Navy Yard, New York, in 1886, where he remained until 1889; commanded the "Dolphin," Special Service, 1889-90; appointed General Inspector of the "Marblehead," September, 1892, in which position he continued until 1896; was Inspector of Ordnance at the Navy Yard, Washington, April, 1896, to 1897.

He was appointed Chief of the Bureau of Ordnance, June, 1897, with relative rank of Commodore, and was commissioned as Captain, July, 1897. While filling the position of Chief of the Bureau of Ordnance, he has the rank of Rear-Admiral.

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LIEUTENANT THEODORE H. FENTON,
Assistant Chief Bureau of Ordnance.

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
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E. S. BRANDT.
Chief Clerk Bureau of Ordnance.

Constitution.

ARTICLE I.

Title and Objects.

Section 1. This Association shall be known as the Ordnance Mutual Relief and Protective Association.

Sec. 2. Its object is to create a fund to be used for the relief of its members in case of sickness or disability.

Sec. 3. To provide a fund to be used in case of death of a member for the relief of those dependent upon him, or anyone he may have previously designated.

ARTICLE II.

Who May Be Members.

Section 1. Its membership shall be confined to persons who, when joining, are employed in the Ordnance Department; but no person shall be eligible to membership who by reason of sickness or other debility is likely to become a burden on the Association.

Sec. 2. Every applicant must have been employed for at least three months in the Ordnance Department, and be known to a member of the Executive Committee.

Sec. 3. Any member of the Ordnance Mutual Relief and Protective Association may become a member of the Mortuary or Death Benefit Fund by paying the required sum as entrance fee to the Financial Secretary and signing the roll of membership.

ARTICLE III.

Officers and Committees.

Section 1. The elective officers of the Association shall be a President, Vice-President, Recording Secretary, Financial Secretary and Treasurer, who shall be elected annually by a majority vote of the members present, and shall hold office until their successors are elected and installed; said officers to be ex-officio members of the Executive Committee.



GEORGE W. SLATER.
President, Ordnance Mutual Relief Association.

Sec. 2. The following committees shall be appointed by the President:

1. An Executive Committee, to consist of seven members, exclusive of the officers, who shall hold office until their successors are appointed; said committee to hold monthly meetings.
2. A Finance Committee, of three members, who shall be appointed at the December meeting.
3. Such other committees as the Association may direct.

ARTICLE IV.

Of Meetings.

Section 1. Stated meetings shall be held on such day and at such hour and place as may from time to time be determined on and designated in the By-Laws.

Sec. 2. Special meetings may be called by the President in his discretion, and shall be called on the written request of seven members in good standing.

ARTICLE V.

Quorum.

Seven members in good standing shall constitute a quorum for the transaction of all business.

ARTICLE VI.

Monthly Dues

Monthly dues shall be such sums as may be prescribed in the By-Laws.

ARTICLE VII.

Use of Funds.

No portion of the funds of the Association shall be appropriated for any purpose whatever other than is provided for in the By-Laws; and no member shall receive as sick benefit a larger sum than is fixed therein.

ARTICLE VIII.

Pro Rata Dividend.

At every annual meeting of the Association the President shall declare a pro rata dividend of all the funds then in the treasury, which dividend shall



THOMAS M. HAYES,
Vice-President, Ordnance Mutual Relief Association.

be paid by the Treasurer to all members of the Association entitled thereto: Provided, That any member having received benefits amounting to more than the pro rata dividend shall not be entitled thereto.

ARTICLE IX.

Disbandment.

By a vote of three-fourths of the members in good standing present at any meeting, when not less than forty members shall constitute a quorum, the Association may be disbanded, and the funds thereof shall be distributed pro rata among the members in good standing at the time of such disbandment, as provided in Article VIII. But no such disbandment or distribution of funds shall be had except due notice in writing shall have been given to all the members of the Association at least one week prior to action thereon.

ARTICLE X.

Authority to Make By-Laws.

Additional to this Constitution, and in harmony therewith, the Association may make all needful By-Laws and Rules of Order, and alter and change the same on one month's written notice—two-thirds of the members present concurring therein.

ARTICLE XI.

Amending the Constitution.

Amendments to this Constitution shall not be acted upon until the succeeding regular meeting after which they are offered; and it shall require a two-thirds' vote in favor to adopt.

AMENDMENTS TO THE CONSTITUTION.

Constitution, Article 5, Section 2, Paragraph 1, strike out the words (7) seven and insert the following:

That the Executive Committee shall consist of not less than (7) seven or more than (10) ten members.



J. E. HARRISON,
Recording Secretary, Ordnance Mutual Relief Association.

By-Laws.

ARTICLE I.

Duties of Officers.

Section 1. President.—The President shall preside at all meetings of the Association and Executive Committee when present, countersign all warrants on the Treasurer, have the custody of and preserve the official bonds of the Financial Secretary and Treasurer, and discharge the duties appertaining to the office of President. He shall call a special meeting of the Association at any time upon the written application of seven members.

Sec. 2. Vice-President.—The Vice-President shall attend all meetings of the Association and Executive Committee, and shall preside in the absence of the President, assuming all his powers and duties.

Sec. 3. Recording Secretary.—The Recording Secretary shall attend all meetings of the Association and Executive Committee, and keep a record of all transactions therein, including the reports of the Financial Secretary and Treasurer; keep a book containing the Constitution of the Association, in which shall be subscribed the names of all the members and the date of the commencement of their membership; call all meetings of the Association and Executive Committee, when ordered by the President, and perform such other duties as may be assigned him.

Sec. 4. Financial Secretary.—The Financial Secretary shall collect all initiation fees and dues, and keep a just and true account of the same; pay them over to the Treasurer on or before the stated meeting in each month, taking his receipt therefor; issue all warrants on the Treasurer in payment of money; report at each meeting the amount received as dues and initiation fees, and the number of members dropped for non-payment of dues or for other reasons; make out the annual dividend, and submit it to the Finance Committee for approval, and perform such other duties appertaining to his office as the Association may direct. He shall be required to give a bond in the sum of five hundred (\$500) dollars for the faithful performance of his duties. At the end of his service he shall deliver to the Executive Committee, or his successor, all books, papers and valuables of every description under his control belonging to the Association.

Sec. 5. Treasurer.—The Treasurer shall receive all funds from the Financial Secretary, giving his receipt therefor; deposit the same in a bank which shall be selected by a committee consisting of the President, Financial Secretary and Treasurer; pay all drafts ordered by the Association or Executive Committee and signed by the President and Financial Secretary. He shall have in his charge the bank book of the Association; keep a correct account of all receipts and disbursements, and at no time shall he retain over \$100 on hand. Whenever required he shall produce his bank book for the inspection of the Executive Committee, and will not, under any circumstances whatever, be allowed to draw moneys from the bank without the



A. B. SUIT,
Financial Secretary, Ordnance Mutual Relief Association.

indorsement of the President and Financial Secretary upon the backs of all checks drawn upon the bank. He shall be required to give a bond in the sum of five hundred (\$500) dollars for the faithful performance of his duties, and at the expiration of his term of office, or in case of resignation, death or inability to perform his duties, he shall deliver, or cause to be delivered, to the Executive Committee or to his successor in office, all the moneys books, papers and valuables of every description in his hands belonging to the Association.

ARTICLE II.

Duties of Committees.

Section 1. Executive Committee.—The Executive Committee shall have a general supervision of the good and welfare of the Association. All applications for membership shall be presented to the Executive Committee, who, after a thorough investigation, shall decide by unanimous vote as to the admission or rejection of the applicant, and duly notify him of their action: Provided, That nothing of a personal character shall influence a member who shall cast a negative vote. In case of rejection of the applicant his fee of \$1.00 shall be returned at the time of said notification.

Sec. 2. To the Executive Committee shall also be referred all applications for the relief of members, and they shall report their action in such cases to the Association at the next regular meeting. They shall ascertain the condition of each applicant for relief, and fully satisfy themselves as to the propriety of granting such relief under the provisions of the Constitution by visiting the sick each day of the week in order to satisfy the committee as to their claim for sick benefits. They shall hold meetings at the call of the President, whenever the business of the Association shall require it, for the relief of the sick or other causes.

Sec. 3. Finance Committee.—The Finance Committee shall make a thorough examination of the accounts of the Financial Secretary and Treasurer at least once in six months (and oftener if so directed by the Association) and make a full report in writing of the same to the Association.

ARTICLE III.

Sick Benefits.

Section 1. Mode of Obtaining.—In the event of the sickness or other disability of any member of this Association, he shall be entitled to receive the sum of six dollars weekly. In all such cases notice shall be given to the President, Vice-President, or Recording Secretary by the applicant for relief WITHIN SIX DAYS, and the same shall thereupon be reported to the Executive Committee, when, if it appears that he is entitled thereto, he shall receive benefits from such time as the Executive Committee shall decide upon; but in no case shall he receive benefits for more than one week prior to application for the same, nor for any period after he has, in the opinion



W. M. MATHIS.
Treasurer, Ordnance Mutual Relief Association.

of said Committee, recovered from such sickness or disability, and when recovered he shall notify the Secretary of date of recovery.

Sec. 2. When Affidavit is Required.—A member taken sick or disabled so far outside of the city limits as to make it inconvenient for a committee to visit him, must accompany his application with the affidavit of a physician, which affidavit shall be received only as prima facie evidence of the sickness of the applicant for relief, and may be rebutted by any other evidence which may come to the knowledge of the Association.

Sec. 3. Benefits Allowed.—Benefits shall not be paid for less than one nor more than six weeks' sickness in one calendar year, except further sick benefits shall be recommended by the Executive Committee: Provided, That one week shall be held to consist of six consecutive working days; and in case a member is unable to work (on account of such sickness for a fractional part of a week in excess of one week and not exceeding the limit of six weeks in one calendar year, said member shall be paid benefits for said fractional part of a week at the rate of one dollar (\$1.00) for each working day.

Sec. 4. When Entitled to Benefits.—Benefits shall not be paid to a member until he has paid monthly dues and been a member for two months, which membership shall commence the first day of the month following the day of his election. This section shall also apply to members who have been reinstated.

Sec. 5. Chronic Disease.—Any member claiming benefits on account of disease which is found to have been contracted and to have manifested itself prior to his admittance, shall be allowed such benefits as the Association may deem advisable: Provided, however, The applicant has truly informed the Association of his condition prior to his election to membership. If he is found to have made false statements, he shall receive no benefits whatever.

Sec. 6. Feigned Sickness.—Any member who shall feign himself sick or disabled for the purpose of obtaining the weekly benefits, shall be expelled from the Association, forfeiting all moneys paid in.

Sec. 7. Excessive Indulgence.—No benefits shall be paid for sickness arising from excessive indulgence or indiscretion.

Sec. 8. At the death of a member his heirs shall be paid full six weeks' benefits, less any amount he may have received during the calendar year.

Sec. 9. Death Benefit.—Upon the death of a member of the Death Benefit Fund, the President shall authorize the Financial Secretary to draw his warrant on the Treasurer for all money in the Treasury to the credit of the Death Benefit Fund, said money to be immediately paid to the person previously designated by the deceased member or to the nearest relative. The payment shall be made within forty-eight hours from time of death.

ARTICLE IV.

Revenue.

Section 1. Initiation Fee.—Every application for membership in this



M. A. LYNCH,
Chairman Executive Committee, and Foreman, Gun Carriage Division.

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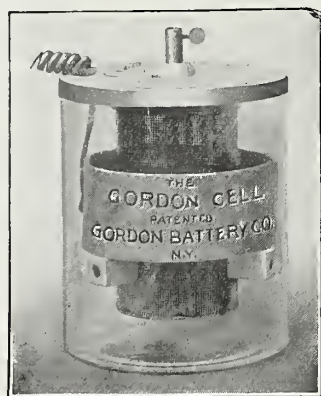
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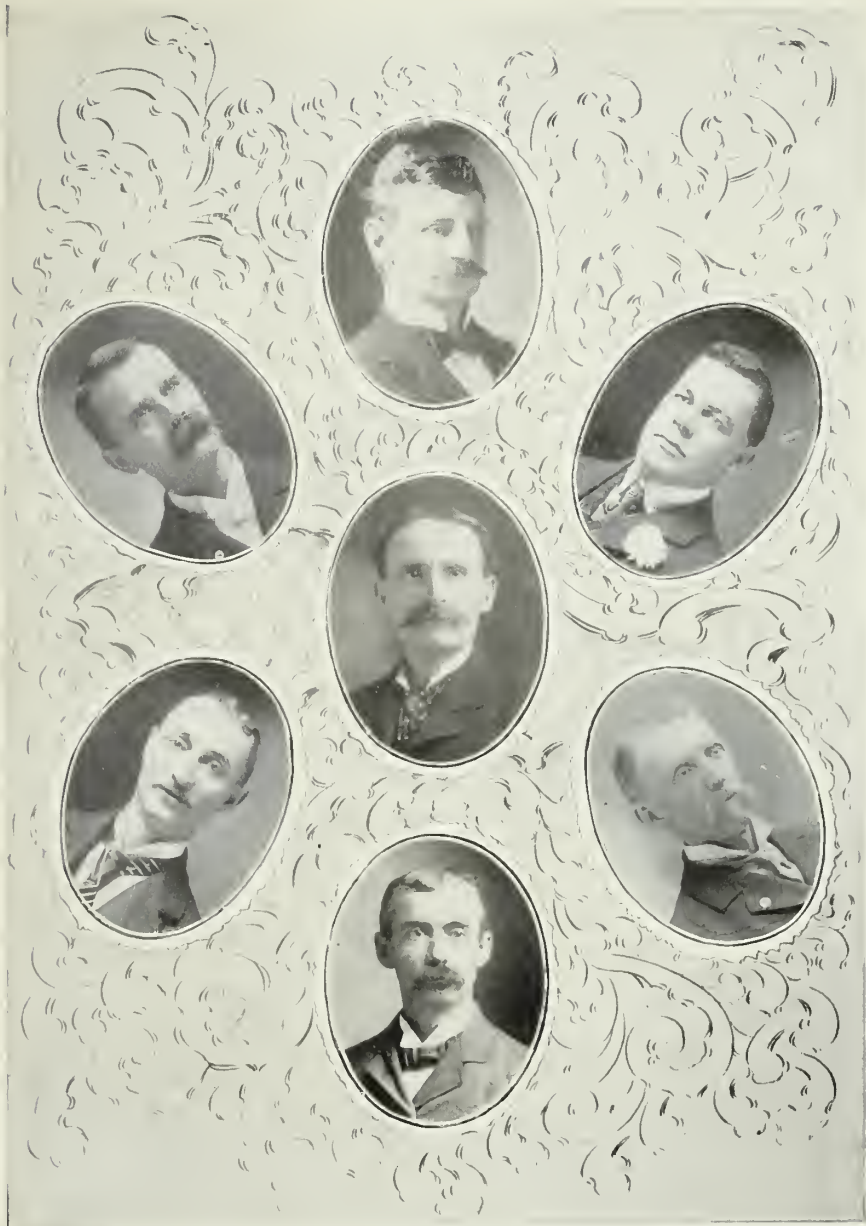
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ROBT. POLLOCK.
ISAAC BENHAM.
E. R. BARBOUR.

WILLIAM G. BETTS.
J. W. FOSTER.

Association must be accompanied by an initiation fee of one dollar, and be indorsed by a member of the Executive Committee.

Sec. 2. Monthly Dues.—Every member of the Association shall pay each month, on or before the 25th, to the Financial Secretary the sum of fifty cents, which shall entitle him to all the benefits and privileges of the Association. Should he fail to make such payment, he shall forfeit his right to benefits for that month. And any member who shall fail to make such payment during that month shall be dropped from the roll of membership, and forfeit all right and claim to relief and benefit from the same. Nor shall any member of this Association who, after having been dropped for non-payment of dues, again become a member unless making application for new membership.

Sec. 3. Death Benefit Fund.—Any member of the Association desiring to become a member of the Death Benefit Fund shall pay the sum of fifty (50c.) cents to the Financial Secretary and sign the roll of membership. The sum thus created shall be set apart for the purpose of paying benefits in case of death of a member.

Sec. 4. Assessments.—Upon the death of a member of the Death Benefit Fund the Financial Secretary shall assess each member the sum of fifty cents to provide for the next benefit, on account of death assessment, to be paid within fifteen days from date of issue.

ARTICLE V.

Salaries.

Section 1. Officers.—The salary of the Recording Secretary shall be twenty dollars per annum; of the Financial Secretary, forty dollars per annum, and of the Treasurer, twenty dollars per annum.

Sec. 2. All general expenses of the Association shall be paid out of any money that may be in the treasury.

ARTICLE VI.

Election and Obligation of Officers.

Section 1. At the January meeting, which shall begin the new year, the annual election and installation of officers shall take place. The voting shall be by ballot, and it shall require a majority vote of those present to elect: Provided, That in the event of a vacancy during the year, caused either by the death, resignation, or other inability of any officer to perform his duties (such vacancy occurring in the interval between regular quarterly meetings), the Executive Committee shall elect his successor to serve until the next regular meeting.

Sec. 2. Before assuming the duties of their respective offices, the officers shall take the following obligation: "I, ———, do pledge my honor that I will, to the best of my ability, discharge the duties devolving on me as ——— of this Association, and earnestly endeavor to maintain its integrity."

ARTICLE VII.

Monthly Meetings.

The Association shall meet semi-annually on the second Tuesday of January and July, at such hour as may be designated by the Recording Secretary. Special meetings may be held, as provided for above, and any business that may properly come before a regular meeting may be transacted at a special meeting. At all meetings seven members shall constitute a quorum for business.

ARTICLE VIII.

Attendance of Officers.

All the officers and members of the Executive Committee failing for two consecutive months to attend the meetings of the Association or Executive Committee, their offices shall be declared vacant, and their successors elected or appointed at the next regular meeting, unless they furnish a reasonable excuse for not attending.

ARTICLE IX.

Preservation of Papers.

All applications for membership, letters, bills, reports or communications pertaining to the business of the Association shall be preserved for future reference by the proper officers.

ARTICLE X.

Withdrawal.

Section 1. No member shall be entitled to demand the return of any money which he shall pay into the treasury of this Association, except in case of his withdrawal from the employ of the Ordnance Department, voluntarily or otherwise; but, in the event of his failure to comply with the Constitution and By-Laws, he shall forfeit all right to the same and all participation in the benefits thereof, and his signature to the Constitution shall be a testament of his agreement thereto.

Sec. 2. When members leave or are discharged from the employ of the Ordnance Department, and leave the city of Washington, and are therefore beyond the jurisdiction of the Executive Committee, they are compelled to withdraw from this Association. They shall be entitled to a pro rata share of the funds, after deducting expenses incurred to the date of withdrawal.

ARTICLE XI.

Dropped Members.

No member of this Association who, after having drawn benefits, allows himself to be dropped, shall again be eligible to membership.



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ARTICLE XII.

Fraud.

Should any member be accessory to any imposition, or aid or abet any other member in practicing a fraud upon this Association, he shall be considered as guilty as the imposter, and also be expelled, forfeiting all moneys paid in.

ARTICLE XIII.

Signing Constitution.

Each member shall sign a book to be kept by the Recording Secretary, which shall contain the Constitution, and shall then become a member in good standing, entitled to all the reliefs and benefits of this Association, subject to the conditions of this Constitution and By-Laws.

ARTICLE XIV.

Amending the By-Laws.

The By-Laws must be amended in the mode provided for in the Constitution.

AMENDMENTS TO THE BY-LAWS.

That the following section be added to Article 5. to be known as Section 3.

Sec. 3. The dues of the President and Vice-President and members of the Executive Committee be remitted for each month they attend the meeting of the Executive Committee, and no excuse shall be taken.

Sec. 8, Article 3. At the death of a member his heirs shall be paid the full six weeks' benefits, less any benefits he may have received during the calendar year.

Sec. 1, Article 3. after the words six days add the following:

And any member failing to report his sickness will forfeit this benefit for the first week.



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Chairman Finance Committee, Ordnance Mutual Relief Association.

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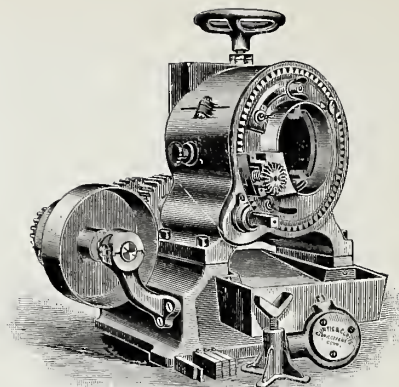
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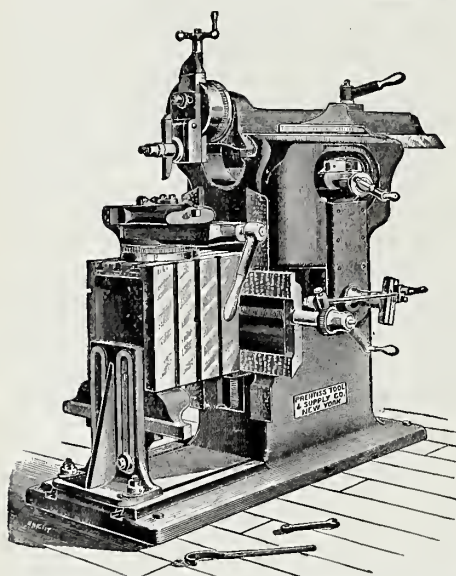


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G. W. GUFFEY.

Interesting Incidents of the Navy Yard.

1800—1900.

The origin of the Navy Yard can be attributed to the first Secretary of the Navy, Hon. Benjamin Stoddert, who urged upon Congress to appropriate \$1,000,000 for building six large Men-of-War, and Boston, Portsmouth, New York, Philadelphia, Washington and Norfolk were selected for Navy Yards to build these vessels. Forty acres of land in the southeast part of Washington was selected for the Washington Navy Yard. B. H. Latrobe, Architect of the Capitol and Public Buildings, prepared the plans. The following is an abstract of the original deed:

This indenture, made the 17th day of March, 1800, between Gustavus Scott and Wm. Thornton, two of the commissioners appointed by virtue of the act of Congress entitled, "An act for establishing the temporary seat of Government of the United States" of the one part and the said United States of the other part intrusteth the said Gustavus Scott and Wm. Thornton, Commissioners as aforesaid for and in consideration of the sum of \$4,000 to them in hand paid by the Secretary of the Navy of aforesaid states, before enscaling and delivery of these presents the receipt whereof they do hereby acknowledge, have granted, bargained, sold, aliened, released and confirmed unto the United States forever all those squares, pieces or parcels of ground in the city of Washington, District of Columbia, known and distinguished on the plan of said city by the numbers 883 and 884, together with all and singular the rights, privileges, benefits and advantages to the same belonging, or any wise appertaining, to have and to hold the said two squares or parcels of ground and appurtenances unto the United States forever, to the sole use and behoof of the United States, in witness whereof the said Gustavus Scott and Wm. Thornton, Commissioners aforesaid, set their hand and affixed their seal the day and year within written.

[Seal.]

GUSTAVUS SCOTT.

[Seal.]

WM. THORNTON.

Signed, sealed and delivered in the presence of

ROBERT BREST,

CORNELIUS CONINGHAM.

Received the 17th day of March, 1800, of the United States, by the hands of the Secretary of the Navy of said States, \$4,000 being the consideration within mentioned.

GUSTAVUS SCOTT,

WM. THORNTON.

Attest:

ROBERT BREST.

The above deed was recorded in the courts of Prince George County, Md., on the 19th day of March, 1800.

According to the deed just mentioned, it shows that the idea circulated that the ground was given for a Navy Yard, and if this is violated it reverts back to the original heirs, is erroneous. The ground was bought, and not made as a gift.

Up to February, 1806, three gunboats were built, costing \$13,000 apiece. The wages per diem at this period were for ship carpenters, 1st class, \$2.00;



REAR-ADMIRAL SILAS W. TERRY.
Commandant U. S. Navy Yard.

2d class, \$1.75; apprentices, \$1.25; calkers, \$1.75; riggers, \$1.50; blacksmiths, \$1.70; coopers, \$1.25; painters, \$1.25; ship and house joiners, \$1.50. The total number employed was two hundred. The expenses for fiscal year ending January, 1806, was \$46,789. In 1808, the force of the Yard was one hundred and seventy-five, among them boys, to turn grindstones and oakum boys.

To many mechanics the wages just mentioned would seem good pay, but the difficulty at that time in doing work was great. A steam cylinder at that time would have to be chipped and filed; planer shears were chipped and filed. Everything was done with hammer, chisel and file; to-day, work is done without hammer, or chisel; it is planed, turned and polished. To do a piece of work a hundred years ago it would require five or six men twenty-four hours; to-day, with the present facilities, the same work could be done by one man in four hours; hence the pay in 1806 was none too much when they had a surface to finish with a hammer, chisel and file; to-day a man has it on a planer leisurely watching it.

The writer of this article, who served his time some twenty years ago, remembers how apprentices had to serve their time. They had to serve on the bench, lathe and shaper, making them good machinists, and if they spoiled any work they were sent in the shed to clean castings.

We had no flooring, candles were our electric lights, and our large planer was fed with a crowbar instead of by power. At the Navy Yard prior to 1840, if a large casting was successfully made the men were given a holiday; to-day if a man loses a big casting he is liable to lose his job. It was only ten years ago that an old planer was thrown out where the shears were chipped and filed by hand in this Navy Yard many years ago. You will notice to-day that a machinist can work with a white shirt on, but twenty or thirty years ago this was impossible. What a change and revolution in machinery has occurred.

Now, returning to our history, we find that Captain Thomas Tingey was the first Superintendent of the Yard. He was selected for the position as he was acquainted with the Navy Yards in England and other places, and in building up a new Yard he was suitable for the place. During the year 1802, the frigates United States, with forty-four guns; General Greene, with twenty-four guns; Essex, with thirty-two guns; Congress, with thirty-six guns; President, with forty-four guns; and the Boston, with twenty-four guns, were lying at the Navy Yard; and in 1804, the Constitution, with forty-four guns; Chesapeake, with forty-four guns; and Constellation, with thirty-six guns, were added to the fleet.

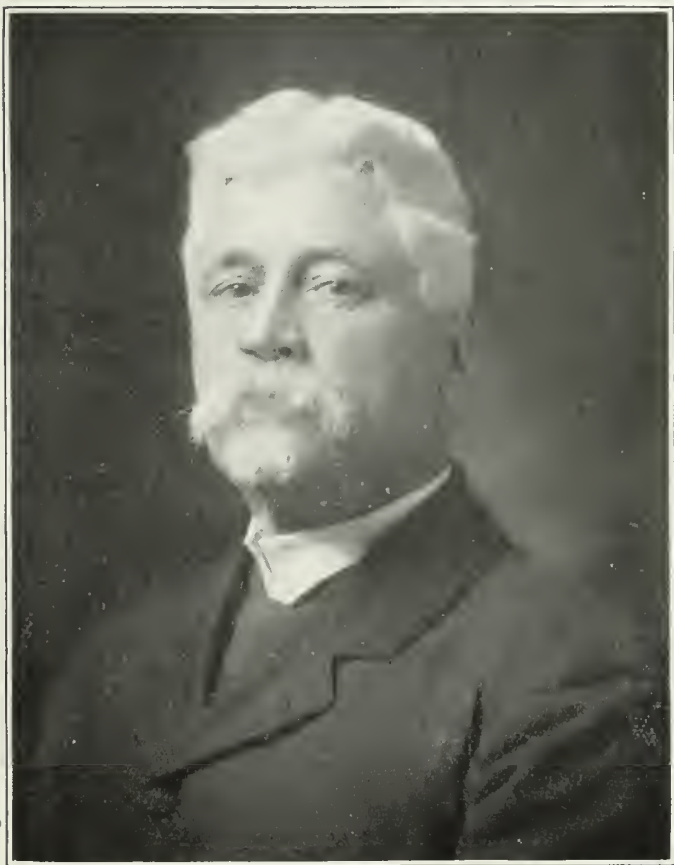
Ten gunboats were under construction up to 1812, nine more gunboats were launched, and now came the disaster and a great blow to the Navy Yard.

The British, under Commodore Barney, came up the Patuxent and landed his troops. The Secretary of the Navy, fearing that the Navy Yard would fall into the hands of the British, ordered the torch applied to the buildings. The following buildings were destroyed: Storekeeper's, Cordage and Sail Loft, Rigging Loft, Ordnance Store, Blacksmith's Shop, Saw and Block Mill and Cooper Shop, entailing a loss of \$417,745. With the burning of the Navy Yard, the Capitol, the Arsenal, Treasury, War Office, President's House, and also the bridge across the Eastern Branch met the same fate.

Robert Fulton offered, at this time, his torpedo boat to blow up the British, but nothing was done.

After the War of 1812 great activity was displayed at the Navy Yard, buildings were erected, and soon the usual hustling was again in action.

In 1819, we find three hundred eighty men on the pay roll from the old record book kept by Foreman Samuel B. Ellis. There are names on the roll such as Wm. Burdine; Daniel Page, Samuel Fowler, Wm. Beardey.



H. H. BROGDEN,
Chief Clerk to Commandant of Navy Yard.

Jonathan Briddle, H. Kingbury, Wm. Dulin, Steinislaw Tench, Wm. Willis, Ignatius Howe. (To-day you will find the names Burdines, Ellis and others on the pay roll, descendants of the same.)

The records show a half-day shut down to pack cylinder. In those days the cylinder piston was packed with hemp, and twelve pounds was the steam pressure; more time lost, tooth in gear wheel broke, stopped to pack cold water pump, another flywheel came loose, man-of-war launched, a holiday, death of Admiral Decatur, a holiday, connecting rod (cast iron) broke, showing how much time was lost, but there is no record showing whether or not the men were paid for lost time. The foreman also advises his men for fever and ague: 60 grains pulverized snake root, 1 oz. of red bark, 30 grains of salt of worm wood, mixed with molasses.

From 1820 to 1832, nothing of importance occurred except the Washington Navy Yard, having been paid too much attention, the other Navy Yards received the bulk of ship building. Also Philadelphia, Boston and Norfolk, having a greater depth of water for larger ships, they were built in those Yards. The frigate Columbia was launched at the Yard; sixty-four guns was her armament.

In 1837 it was first mentioned to have a foundry to cast guns at the Washington Navy Yard.

In 1843, Sloop of War St. Mary and the steamers Union and Water Witch were launched. In 1844 the statue of Washington, stored in the Yard, was removed and placed in front of the Capitol. In 1848 tools and machinery of a modern pattern were built and bought. In 1856 the U. S. S. Plymouth was repaired, and under Commander Dahlgren left the Yard to practice with the nine and eleven-inch Dahlgren guns.

The Civil War now coming on, the Navy Yard was put in a fortress-like condition; the number of marines and volunteers stationed in the Yard was three hundred forty-eight, with steamers Mt. Vernon, Artesan, Pawnee, Anacostia, Yankee, Keystone, United States, Philadelphia and Powhatan. All employees in the Yard were made to swear allegiance to the United States.

In 1862, the men in the Yard applied through the Commandant to the Secretary for an increase of salary, or to be allowed extra compensation for overtime; nothing was done with the plea.

The hours of labor fixed by act of Congress, Jan. 12, 1862, were as follows:

Rules for ringing bells in all Navy Yards, except on Sundays, at seven o'clock A. M., 12 o'clock noon, one o'clock P. M., and six o'clock P. M. When the sun rises later than forty-five minutes after six the bell must be rung fifteen minutes after sunrise, and when the sun sets before six o'clock it must be rung at sun-set.

While the Civil War lasted there were exciting times in the Navy Yard; gunboats, steamers and barges were kept waiting for the enemy to come up the Potomac. The Navy Yard was armed with three nine-inch guns and five howitzers. In April the Navy Department sent a circular to the different iron manufacturing companies to send specimens of plates to be tested. In 1858 it was first agitated and recommended experiment of armor for ships, but nothing was done until 1862. The manufacturers could not comply, as they were too busy.

In 1863, the work in the Yard being very pressing, and on account of the war cost of living being greater, the men sent the following note to the Department:

We, the workmen of the Navy Yard, joiners, plumbers, blacksmiths, machinists, painters, boiler makers, and others, do pledge ourselves to sustain each other in endeavoring to obtain the old system of working hours, after sunrise until sunset, and also an advance in wages of twenty-five per



COMMANDER EUGENE H. C. LEUTZE,
Superintendent U. S. Naval Gun Factory

cent. After using all honorable means, we will strike, and not work until our grievances are redressed. An answer is asked by Monday, the thirtieth instant, 1863, before sunset. After a few weeks the hours were changed and wages adopted the same as paid by the War and Treasury Departments. The number of men employed in the Yard was six hundred. In 1864 the men again asked for more pay, but nothing was done.

The following vessels were in the Yard repairing: Western World, Wyandotte, Ella, Baltimore, Queen, King Phillip, The Don Bibb, and Tiger.

For better defence portholes were cut in the walls of the Yard, guns set up on platforms in range of the holes, and the French Corvette *Amplion* received repairs at the Yard.

In the beginning of the year 1865, the Rebellion showing a decline, and as the news came that Richmond was taken, orders were given to illuminate all buildings. The question was asked, "How many candles are on hand," and carpenters were put to work, but this spirit of joy was soon overcast with gloom by the death of Lincoln.

At the Yard, then on board the iron clad *Montauk*, were the prisoners Atzerott, Paine, Harrold, and the remains of Wilkes Booth. These prisoners were kept in the Navy Yard until their trial, when they were transferred to the Arsenal, where they were convicted.

Soon after the close of the war, a reduction of expense was ordered for the Navy Yard, and the force was reduced in September, 1865. Twelve hundred thirty-eight men were on the pay roll in 1868 when the force was reduced to eight hundred sixty-one.

Mr. Geo. R. Wilson gave an estimate that nine broadside gun carriages of wrought iron could be built at a cost of two hundred dollars each.

The men of the Yard presented a petition for balance two-tenths pay due them, and employed Ben. Butler to defend their case, but it failed on account of the Statute of Limitation. The following work in 1869 was going on:

Repairs to tugs *Nina*, *Triana*, *Nipsic* and *Cambridge*; monitors *Montauk*, and monitor famed for its battle with the *Merrimac*, and the monitors *Hero* and *Oliver* were dismantled. New machinery was put in the copper rolling mill, also preserving machinery on boats, and the *Phlox* was repaired. Thirty-nine apprentices were employed in the Yard. In 1870 steamers *Tallapoosa*, *Periwinkle* and *Polaris* were repaired, the latter two vessels went on a North Pole expedition.

The Department issued an order that no article could be taken out of the Yard without a written order from the Executive Officer. Records of 1870 will show that not every article was under lock and key, as thirty-one colt's revolvers were stolen.

During 1871 and 1872 there was not much activity in the Yard. From 1873 to 1875 work increased; the *Nipsic*, *Gettysburg*, *Despatch*, *May Flower*, *Triana* and *Wyoming* were under repairs. Complaints were made of the Eastern Branch filling up and vessels getting aground, especially in the case of the ship *Saratoga*.

In 1877, an order establishing the following hours of labor was issued by the Department:

From March 21, to September 21, seven A. M. to six P. M.; from September 22, to March 20, seven-forty A. M. to four-thirty P. M.

In February, 1878, the *Wyoming* got stuck in the mud, and it took the steamers *Tallapoosa*, *Rescue* and *Fortune* to pull her off. Notice was sent to the Department that no vessel could leave the Yard without difficulty. In July of the same year the statue of Farragut was cast. May 5, 1881, the U. S. S. *Dispatch* and *Tallapoosa* left for the Yorktown Centennial. On October 28 a serious explosion of rockets took place, and George Lawrence was killed, and Marion Thompson and George Gates were seriously injured. Decoration Day was observed, and all men received pay for it. In 1883 the



JESSIE V. K. LEE,
Chief Clerk Naval Gun Factory.

first Breech Mechanism was made. In 1884 the May Flower sank at the wharf. A lot of brass cannon captured during the Civil War was ordered sold to the Grand Army. An effort was made to reduce the force in the Yard, but was objected to by the Commandant. During the President's inauguration the sixth regiment of Pennsylvania was permitted to quarter themselves in the Moulding and Rigging Lofts.

In 1885 Hon. Wm. C. Whitney, Secretary of the Navy, issued an order abolishing several departments in this Yard and practically turned it over to the Ordnance Department for the purpose of manufacturing guns, mounts, etc. From that time until the present many improvements have been made in the Yard in the way of building new shops and converting the old ones into modern ones, discarding old and obsolete machinery and tools and establishing up-to-date methods for producing the highest type of work done anywhere in the world. Many representatives of large private establishments, such as Carnegie's, Bethlehem, Midvale and also some representatives from large European plants have expressed themselves as being highly pleased with the character of work, methods, etc., and all are free to admit that the Naval Gun Factory of to-day is equal to any of the above well known establishments. It is the means of saving the Government millions of dollars in manufacturing these guns, mounts and accessories here, furthermore, it is under the eyes of the officers and men who have to handle them on board ship and they have a chance to become perfectly familiar with the manufacture of them.

Officers of the Washington Navy Yard.

Silas W. Terry, Rear Admiral, U. S. N., Commandant.

E. H. C. Leutze, Commander, U. S. N., Superintendent, N. G. F.

H. C. McCrea, Lieutenant Commander, U. S. N., Senior Assistant.

Wm. B. Caperton, Lieutenant Commander, U. S. N., 8 and 12-inch Guns and Mounts.

Frank E. Beatty, Lieutenant Commander, U. S. N., Cartridge Cases and Miscellaneous.

Mark L. Bristol, Lieutenant, U. S. N., 4, 5 and 6-inch Guns and Mounts.

Wm. C. Cole, Lieutenant, U. S. N., 3-inch Guns and Mounts.

Nathan C. Twining, Lieutenant, U. S. N., Fuzes and Miscellaneous.

Wm. K. Harrison, Lieutenant, U. S. N., 1 and 6-pounder Guns and Mounts.

V. O. Chase, Lieutenant, U. S. N., Draughting Room.

Arthur T. Chester, Lieutenant, Junior Grade, Assistant to Lieut. Bristol.

J. J. Walsh, Chief Gunner, U. S. N., Charge of Shell House and Bellevue Magazine.

Gastone D. Johnstone, Gunner, U. S. N., Assistant to J. J. Walsh.



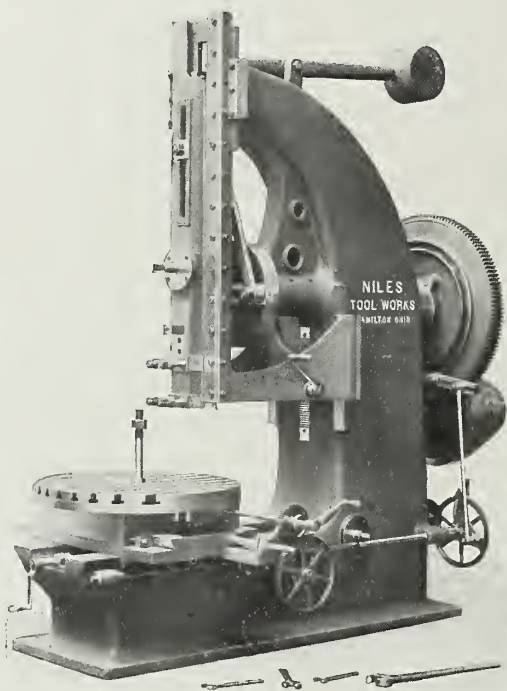
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 Lieutenant-Commander W. M. B. CAPERTON, Lieutenant V. O. CHASE, Lieutenant-Commander FRANK E. BEATTY, Lieutenant MARK L. BRISTOL
 Lieutenant-Commander HENRY McGREA, Rear-Admiral SILAS W. TERRY, Commander E. H. C. LEUTZE.



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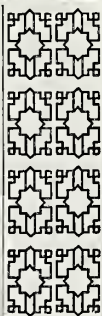
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2. " Isaac Hull	Mar. 31, 1829.	Oct. 1, 1835.
3. " Jno. Gallagher	Oct. 1, 1835.	Mar. 1, 1836.
4. " Daniel T. Patterson.....	Mar. 1, 1836.	Aug. 25, 1839.
5. " Thos. Holdup Stevens.....	Feb. 26, 1840.	Jan. 21, 1841.
6. " Beverly Kennon	Apr. 27, 1841.	Mar. 7, 1843.
7. " Jno. H. Aulick.....	Mar. 7, 1843.	Feb. 21, 1846.
8. " W. B. Shubrick.....	Feb. 24, 1846.	July 9, 1846.
9. " Chas. S. McCauley.....	Sept. 1, 1846.	Oct. 1, 1849.
10. " Henry E. Bullard.....	Oct. 1, 1849.	Oct. 15, 1852.
11. " Chas. W. Morgan.....	Oct. 15, 1852.	Jan. 5, 1853.
12. " Hiram Paulding	Jan. 21, 1853.	Jan. 30, 1855.
13. " French Forrest	June 30, 1855.	Aug. 15, 1856.
14. " E. A. F. Larallette	Aug. 15, 1856.	May 14, 1858.
15. " Jno. Rudd	May 15, 1858.	Apr. 30, 1859.
16. " Franklin Buchanan	May 26, 1859.	Apr. 22, 1861.
17. Commander Jno. A. Dahlgren.....	Apr. 22, 1861.	July 22, 1862.
18. Commodore Andrew A. Harwood.....	July 22, 1862.	Dec. 31, 1863.
19. " Jno. B. Montgomery.....	Dec. 31, 1863.	Oct. 13, 1865.
20. " Wm. Radford	Oct. 13, 1865.	Jan. 20, 1869.
21. " Chas. H. Poor.....	Jan. 20, 1869.	Aug. 10, 1870.
22. Rear Admiral Jno. A. Dahlgren.....	Aug. 10, 1869.	July 12, 1870.
23. " " Melancthon Smith	July 19, 1870.	Oct. 14, 1870.
24. " " L. M. Goldsborough.....	Oct. 14, 1870.	Oct. 1, 1873.
25. Commodore Thos. H. Patterson	Oct. 1, 1873.	Oct. 10, 1876.
26. " Jno. C. Febiger.....	Oct. 10, 1876.	June 1, 1880.
27. " Thos. Pattison	July 10, 1880.	May 30, 1883.
28. " Alex. A. Semmes.....	June 30, 1883.	Sept. 22, 1885.
29. Rear Admiral Walter W. Queen.....	Oct. 5, 1885.	Oct. 6, 1885.
30. Captain Rush R. Wallace.....	Mar. 28, 1887.	Sept. 15, 1887.
31. " Richd. W. Meade.....	Sept. 15, 1887.	Sept. 15, 1890.
32. Commodore Jos. S. Skerrett	Sept. 15, 1890.	Dec. 31, 1892.
33. " Jno. A. Howell	Feb. 2, 1893.	May 23, 1896.
34. " Chas. S. Norton.....	May 23, 1896.	Oct. 17, 1898.
35. Captain A. H. McCormick.....	Oct. 17, 1898.	
36. Rear Admiral Silas W. Terry	1900-1901.	

The New Battleships of United States Navy.

When Congress, in March, 1899, appropriated money for three sea-going coast-line battleships, carrying the heaviest armor and most powerful armament for vessels of their class, it was evidently the intention to provide for vessels more powerful than those of any other nation in the world. The unfortunate provision by which the contracts for the vessels were made subject to an agreement as to the price of armor while it delayed the work served one good purpose in making it possible to combine with them the two battleships provided for by the act of June 7, 1900.

The vessels appropriated for in 1899 are required to be sheathed and coppered, whereas those of the later appropriation have been held by the Navy Department not to be covered by the provision as to sheathing, and the Bureau has, therefore, designed two classes of vessels, one sheathed and the other not sheathed.

The general dimensions and chief characteristics of the sheathed and coppered vessels are:

Length on load water line, 435 ft.

Breadth extreme at load water line, 76 ft. 10 in.

Trial displacement, about 15,000 tons.

Mean draught at trial displacement, about 24 ft.

Greatest draught, full load, about 26 ft.

The general dimensions of the unsheathed vessels are:

Length on load water line, 435 ft.

Breadth, extreme, at load water line, 76 ft. 2½ in.

Trial displacement, about 14,600 tons.

Mean draught at trial displacement, about 24 ft.

Greatest draught, full load, about 26 ft.

In the 15,000 tons, represented in each of these vessels, the many antagonistic qualities essential to a perfect fighting machine have been compromised and incorporated in proportions which experience seems to have pointed out as the most desirable and efficient.

The vessels will be propelled at this high speed by twin screws driven by two 4-cylinder, triple-expansion engines of about 19,000 indicated horsepower, having a stroke of four feet, running under conditions of maximum speed at about one hundred and twenty revolutions a minute. The steam necessary to this power will be supplied at a pressure of 250 pounds a square inch by twenty-four Babcock & Wilcox straight water-tube boilers, placed for in each of six independent watertight compartments.

Each ship will carry four 12-inch guns, forty calibers in length, mounted in pairs in Hichborn balanced turrets, having an arc of train of 270 degrees, one forward and one aft in each vessel. Of the 8-inch guns, forty-five calibers in length which will be carried on each of the three sheathed vessels, four will be mounted in turrets of the Hichborn type, superimposed upon the 12-inch turrets, and four in two turrets amidships, having an arc of train of 180 degrees; and in the two unsheathed vessels, all eight 8-inch guns will be mounted in four independent turrets, having an arc of train of 145 degrees, placed two on each side at the ends of the superstructure, thus forming a quadrilateral. In each vessel there will be a broadside of twelve 6-inch rapid fire guns, fifty calibers in length, mounted six on each side on the main deck, each with an arc of train of 110 degrees, and each will also have twelve 14-pounders and twelve 3-pounders mounted in commanding positions and having very large arcs of fire. In the two lower tops there will be four automatic 1-pounders, and in the upper tops four single shot 1-pounders.

Experience having shown that above water, torpedo tubes are not on'y inefficient weapons, but also a menace to their possessors, the vessels are fitted only with submarine torpedo tubes. Two of these are located in one

compartment, one on each side, fitted for the discharge of the large 18-inch Whitehead torpedo, and provision is made for carrying stored in the torpedo room six of these formidable engines of war.

Provision will be made in the magazines for the storage of at least sixty rounds for each of the 12-inch guns, representing a weight of about 144 tons; 125 rounds for each of the 8-inch guns, weighing about 180 tons; 200 rounds for each of the 6-inch guns, the weight of which will be about 190 tons; 500 rounds for each of the 3-pounder and 1-pounder guns, and an almost inexhaustible supply of ammunition for the smaller guns.

So much for the vessels' offensive qualities. To make their defensive qualities proportionately great, they are to have a complete water line belt of armor 8 feet in width amidships, 11 inches thick at the top and 8 inches at the bottom, tapering to a uniform thickness of 4 inches at the ends of the vessel. They will also have an armored belt extending over 245 feet of their length, of a uniform thickness of 6 inches, rising from the top of the main belt to the upper or main deck, and joined at its after end to the barrette of the 12-inch turret by a 6-inch armored bulkhead, and having at its forward end an inclined armored bulkhead from side to side 6 inches thick, thus forming a citadel or redoubt within which the 6-inch guns will be mounted. The barbettes for the turrets of the 12-inch guns are to be 10 inches in thickness for that portion outside of the redoubt or citadel, reduced to six inches in thickness within.

The turrets themselves will be protected by armor 10 inches in thickness, the port plates, however, being 11 inches. The 8-inch turrets will in all cases, whether superposed or independent, be protected by 6 inches of armor, with 6½-inch port plates, and their barbettes will be protected by similar armor. The conning tower and its shield will be 9 inches in thickness, and the armored tubes will be protected by 6 inches of armor and will be of sufficient size not only to receive all the voice pipes, wiring, &c., but also to permit of their being used as a passageway, if necessary. In addition to the conning tower there will be aft a second tower known as the signal tower, which will be protected by 5-inch armor.

From the bottom of the water line armor belt there will rise a curved turtle-backed nickle-steel protective deck 1½ inches thick on the flat and 3 inches thick on the sloping sides, to make assurance doubly sure that no projectile of the enemy shall find its way into the vitals of the ship. As an additional protection to stability, a coffer-dam belt, 3 feet in thickness and packed to a density of eight pounds to the cubic foot, will be worked, along the two sides, about the protective deck for the entire length of the vessel.

It is proposed to make all of these vessels flagships, and to do this it is necessary to make provision for the accommodation of one flag officer, one commanding officer, one chief of staff, twenty wardroom officers, twelve junior officers, ten warrant officers, and 658 crew and marines, making a grand total of 703. Both officers and crew will have washrooms, bathrooms, and other similar conveniences, such as will place the comfort and healthfulness of these vessels very high in the scale.

The applications of electricity on board are very much wider than in the case of any other battleships in existence, with the possible exception of the "Kearsarge" and "Kentucky." All the turrets have electrical turning-gear, and the ammunition hoists, blowers to the turrets and general ventilation, the general workshop and practically all of the auxiliaries, outside of the engineers' department, and excepting capstan and steering-gear, are to be electrically driven. To provide for the power required for these purposes, there will be installed in three ships with superposed turrets eight engines and dynamos, mounted on combination bed-plates, two having a rated output of 1,250 amperes at 80 volts, and six with 625 amperes at 80 volts. The two ships with the 8-inch guns in quadrilateral arrangement will be provided with ten engines and dynamos, mounted on combination bed-plates, two with a rated output of 1,250 amperes at 80 volts, and eight with 625 amperes at 80 volts.

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United States Torpedo Boat "Bagley."

The "Bagley" is one of the twelve torpedo boats authorized by Act of Congress, May 4, 1898. As usual in the U. S. Navy, the advertisement for bids for constructing vessels was so worded that the bidders were permitted to submit estimates on the Government plans and specifications or bid on designs and specifications of their own. As a result three of these twelve torpedo boats, of which the "Bagley" was one and the "Barney" and "Biddle," the other two (the three "B's"), was awarded to the Bath Iron Works, of Bath, Maine, on that firm's design. The contract price for each being \$161,000.

The vessels are sharp, knife-like, marine structures, intended for quick offensive action, where speed is the principal requirement. They are 157 feet in length, 17 feet in breadth and on a normal displacement have a mean draft of water of 4 feet 7½ inches. The approximate normal displacement is 167 tons. They are fitted with twin screw vertical quadruple expansion engines, Normand type, developing 4,200 indicated horse power at 28 knots speed.

Their armament consists principally of three eighteen-inch Whitehead torpedo guns, two for broadside work and one aft for stern fire, and three 3-pounder rapid fire guns for defensive purposes against craft of their own class. The crew for each consists of three officers and twenty-six men.

The "system" at present followed by the Navy Department in selecting names for torpedo boats is to give to each the name of a deceased naval officer whose heroism or gallant services has merited distinction at the hand of the United States. The "Bagley" therefore was named for Worth Bagley, Ensign, U. S. N., who was born in Raleigh, North Carolina, April 6, 1874, and who lost his life in the action in Cardenas Bay, Cuba, on the torpedo boat "Winslow," May 11, 1898. Ensign Bagley has also the distinction of being the only naval officer killed in action during the Spanish-American war.

The "Bagley" will, in all probability, be launched from the Bath Iron Works yard this year and be christened by Mrs. Adelaide Worth Bagley, mother of the son the United States has thus honored.

In an endeavor to erect a monument to her son and as evidence of motherly love, Mrs. Bagley has secured permission from the Navy Department to place on the after conning tower of this boat a bronze tablet in memoriam of her boy who so gallantly gave his life in the cause of his country.

The design for this tablet may be thus described: In general form, circular, about thirteen inches high and ten inches wide. A circular ring containing twenty four hemispheres, emblematical of the age of Ensign Bagley at the time of his death. At the base an American shield upon which rests a sword, emblematical of the sword and belt of the young hero placed at rest on the altar of his country. Rising from the shield is an American eagle, its wings enclosing the legend: "Worth Bagley, Ensign, U. S. N. Born, Raleigh, North Carolina, April 6, 1874. Killed in Action, Cardenas Bay, Cuba. Torpedo-boat 'Winslow,' May 11, 1898." The top figure represents the conning tower of the "Winslow," nearby where the young hero was killed. Each side of the conning tower are American flags mingling with bay leaves. Below the tower and above the name, "Worth Bagley," is a representation of a 1-pounder gun, near which the Ensign stood when killed by the enemy's shell.

This beautiful and appropriate design was prepared in the Bureau of Construction and Repair, Navy Department, under the direction of Chief Naval Constructor Philip Hichborn, U. S. N.

The sister ships to the "Bagley," the "Barney" was launched July 28, 1900, and the "Biddle" will be put in her native element in the near future.

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NEW PROTECTED CRUISER "DENVER" AND CLASS.

The New Protected Cruisers "Denver," "Des Moines," "Chattanooga," "Galveston," "Tacoma" and "Cleveland."

The six new cruisers of the "Denver" class are in one respect, that of being sheathed and coppered, a radical departure from previous practice; and they are in all other respects up to date. For many years Chief Constructor Hichborn stood almost alone in his advocacy of sheathing for ships' bottoms, but persistent argument, combined with many object lessons from the reports of our ships in service, which tended to prove the statements in favor of sheathing, have at last overcome the strong prejudice against it, and all of the twelve ships authorized by the last Congress—three first-class battleships, three first-class armored cruisers and six protected cruisers—are to be sheathed and coppered.

On account of the Congressional limitation of the price which the Department may pay for armor, the six ships of the "Denver" class are the only ones for which contracts can be made without further action of Congress. Designs for these ships are now being rapidly perfected by the Bureau of Construction and Repair. They will be vessels of about the size of the "Raleigh" and "Cincinnati," but improved and modernized. The latter ships were designed at the time when the craze for speed at all costs reached its maximum, and to attain this extreme speed, which it will be noted could only be maintained for a few weeks after they were docked and cleaned, on account of their rapidly fouling unsheathed bottoms, too many other qualities were sacrificed, and they are now being altered to remedy this defect. The "Denver" and her sister ships, "Des Moines," "Chattanooga," "Galveston," "Tacoma" and "Cleveland," are designed for a speed of 16½ knots, but will only make 17 knots when pushed, while the "Raleigh" and "Cincinnati" were designed for a speed of 19 knots. The former will be able to maintain their designed speed practically indefinitely, while the latter could scarcely maintain a speed of 15 knots, and that with an excessive consumption of coal. The horse power required in the new designs is 4,500, as compared with 10,000 in the "Raleigh" and "Cincinnati," which means less than half the weight of propelling machinery.

The general dimensions and features of the "Denver" and sister ships of her class will be as follows:

Length on load water line.....	292 ft.
Length, extreme	308 " 2 in.
Breadth, extreme, about.....	43 "
Mean draft at trial displacement, $\frac{3}{8}$ coal, ammunition and stores.....	15 " 6 "
Extreme draft, fully loaded.....	16 " 8 "
Trial displacement, about.....	3,100 tons.
Full load displacement, about.....	3,400 "
Coal carried on trial.....	470 "
Total bunker capacity, not less than.....	700 "
Speed on trial.....	16½ knots.
Type of engines, vertical inverted, 4-cylinder, triple expansion.	
Estimated indicated horse power.....	4 500
Type of boilers, water tube.	
Number of boilers.....	6

Main Battery.

10 5-in. 50-cal. B. L. R. F. guns

Auxiliary Battery.

8 6-pdr. R. F. guns.

2 1-pdr. R. F. guns.

4 Colt machine guns.

Sail area, about..... 6,000 sq. ft.

The guns will all be designed for smokeless powder, and the 5-inch guns will be more effective than the old type of 6-in guns. Eight of them will be mounted on the main deck in recessed ports, the four forward ones having a range from right forward to 60 degrees abaft the beam, and the four after ones from right aft to 60 degrees before the beam. The two remaining 5-inch guns will be mounted behind shields on the spar deck, one forward and one aft. Four 6-pounders will be mounted on the main deck, two forward and two amidship, and four more on the spar deck. The two 1-pounder guns will be mounted aft on the main deck, and the Colt machine guns on the top of the hammock berthing amidship.

The coal capacity of these ships with bunkers full (700 tons) is sufficient to give them a radius of action at full speed of about 2,600 miles. At the most economical rate of steaming, probably in the neighborhood of 10 knots per hour, they will be able to steam about 9,800 miles without recoaling, or more than sufficient to take them from San Francisco to Manila. The ammunition supply will be large, as it should be to make rapid-fire guns effective. For each of the 5-inch guns they will carry 250 rounds, and for each of the 6-pounders, 500 rounds.

The wood material used in the construction of the hulls will be reduced to a minimum. All the bulkheads on the gun and berth decks will be of metal, and they will each be fitted with a pilot house on the spar deck built entirely of non-magnetic metal. Where it is necessary to use wood for any purpose it will be treated with the electric fireproofing process before being worked. A watertight deck covered with $\frac{1}{2}$ -inch plate will be worked from stem to stern, the sides sloping down to 3 feet below the water line, and the flat or midship portion rising 18 inches above the same. This will be on the line of the berth deck for the greater part of the length, but toward the ends it will slope down. On top of the watertight deck at the sides a belt of obliterating material will be worked, covering the water line for the whole length of the ship. All of the propelling machinery, steering gear and magazines will be below the watertight deck. The rig will be two-masted schooner, with signal yards on the foremast.

Each vessel will have two searchlights, an electric signalling system, and a complete installation of electric lights. The blowers for ventilation and deck winches will be operated by electricity.

Each ship will carry one 30-ft. steam cutter, one 30-ft. launch, two 28-ft. cutters, two 26-ft. cutters, one 28-ft. whaleboat gig, one 28-ft. whaleboat, and one 18-ft. dinghy. The complement will be 27 officers, 238 seamen and 25 marines.

The "Denver" is being built by Neafie & Levy Shipbuilding & Engine Co., Philadelphia, Pa.; "Des Moines" by Four River Engine Co., Weymouth, Mass; "Chattanooga" by Crescent Ship Yard Co., Elizabeth, N. J.; "Glaveston" by Wm. R. Trigg Co., Richmond, Va.; "Tacoma" by Union Iron Works, San Francisco, Cal.; and the "Cleveland" by Bath Iron Works, Bath, Maine.

United States Monitors "Arkansas," "Connecticut," "Florida" and "Wyoming."

The United States revolutionized naval construction and methods in 1861, and it has been revolutionizing them ever since. It is true that other nations have been progressing more rapidly numerically, but scientifically, in hulls, machinery and armaments, the United States Naval Constructors have again set the pace of the world. The experiences of the war with Spain have suggested new departures. The ships of the future additions to the American Navy will be a marked advance on former designs.

The naval program for 1898-99, under the Act of May 4, 1898, provides for three first-class battleships, four coast defense monitors, twelve torpedo boats and sixteen torpedo boat destroyers.

The four harbor defense monitors called for present some of the most radical advances in the modern fighting machinery. The monitor principle has always been distinctively American. There are many who regard them as the best all round warships yet designed.

The Act of Congress appropriating for the naval service for the fiscal year ending June 30, 1899, under "Increase of the Navy," referring to the four harbor defense vessels of the monitor type, limits the cost of the vessels to \$1,500,000 each. The limit of time of completion is twenty-seven months, with penalties from \$300 to \$500 a day for failure.

The Navy Department, in the construction of this class of vessels securing the greatest results at the least expenditure of money, has in view not only the securing of the mainland harbors of the United States, but also of its island possessions in the Atlantic and Pacific oceans.

The design for the monitors, which have been named the "Arkansas," "Connecticut," "Florida" and "Wyoming," was prepared by Chief Constructor Hichborn. It was decided that the best all round arrangement that could be built with the available appropriation was the arrangement with a single balanced turret on the center line forward, containing two high-powered 12-inch breech-loading rifles, a gun that has just been designed to be used with smokeless powder; four 4-inch rapid-fire breech-loading rifles, also to be used with smokeless powder, completes the main battery. The secondary battery will consist of three 6-pounder rapid-fire and four 1-pounder automatic rifles.

The general characteristics of these vessels as shown in the elements of design are:

Length on load water line.....	252 ft.
Breadth, extreme, at water line.....	50 "
Mean draft, at normal displacement.....	12 " 6 in.
Normal displacement, about	3,235 tons.
Total coal capacity, loose stowage.....	400 "

In the details of design appear these characteristics:

The hull is of steel, not sheathed, with double bottom and close watertight subdivisions.

There is one military mast, fitted with fighting and searchlight tops.

Seven boats are stowed clear of the blasts of the guns. Two, being life-boats, are to be carried at davits, so as to be quickly lowered.

The protection of the hull against injury to the water line region is afforded by means of a side armor belt, the maximum thickness being 11

inches, tapering to 5 inches at the armor shell, the depth being 5 feet. The maximum thickness is abreast the engine and boiler spaces; from thence forward and aft it is reduced by steps to a minimum thickness of 5 inches at the bow and stern. The barbettes for the 12-inch guns have armor about 10 inches thick.

The turret is of the Highborn balanced type, with front plate inclined forty-two degrees from the vertical. The side plates of the turret armor are 9 inches thick.

The main or protected deck extends throughout the length of the vessel, and is worked flat. The total thickness will be $1\frac{1}{2}$ inches.

A conning tower of $7\frac{1}{2}$ inches in thickness, having an armored communication tube 3 inches in thickness, is carried in a suitable commanding position forward, the tube extending to the armor deck, and affording protection to the voice tubes, bell wires, etc.

The vessel is driven by twin screws. The engines (two in number) are of the vertical, triple-expansion type, in one water tight compartment. The high pressure cylinder 17 inches in diameter, the intermediate $26\frac{1}{4}$ inches, and the low pressure 40 inches; the stroke of engines to be 24 inches. The boilers (four in number) are of the water-tube type, constructed for a working pressure of 250 pounds, and are placed in one watertight compartment. There are the usual auxiliary machinery and workshop tools.

Distilling apparatus and evaporators are fitted for supplying fresh water.

The total coal bunker capacity allows at least 400 tons with loose stowage without trimming.

The total weight of machinery (but not including turret-turning machinery, capstan, windlass, steering gear, or winches) is limited to 240 tons. Fifty tons of water for steaming purposes must be carried in the double bottom.

Steam windlass, steering engines and boat winches are provided.

These vessels have staterooms in addition to one for the Captain, for six officers; require a complement of crew of 125, for whom ample berthing space has been provided. Storerooms are provided for one month's supply of clothing, contingent and small stores.

The electric generating plant consists of four units, each unit to have an engine, dynamo, and compensation bed plate, and each dynamo a rated output of 400 amperes of 40 volts.

The turret-turning gear, ammunition hoists, elevating gear, rammers and ventilating apparatus are operated by electricity.

The estimated speed of the vessel is to be $11\frac{1}{2}$ knots—amply sufficient for a harbor defense vessel.

All wood used in the construction of the vessels is fireproofed.

The vessels are fitted with docking keels, which will also serve the purpose of bilge keels.

These harbor defense monitors, which have all the latest improvements known to naval science, are important additions to the Navy, and, being small, with large accommodations for crew for vessels of their size, they are valuable for the use and instruction of the Naval Militia, that important organization which has so ably served the Government in the late war with Spain.

The "Arkansas" is building at Newport News, Va.; the "Connecticut" at Bath, Me.; the "Florida" at Crescent Steel Yard, at Elizabeth, N. J.; and the "Wyoming" at Union Iron Works, San Francisco, Cal.

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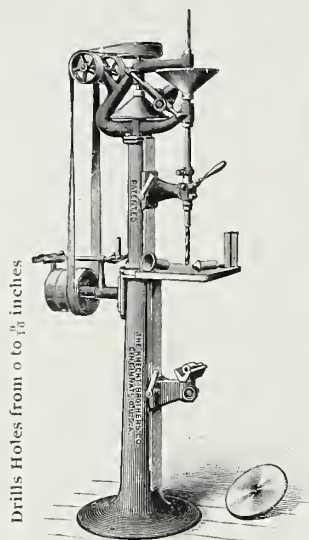
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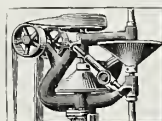
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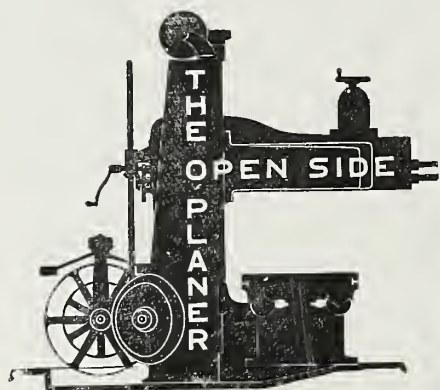
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Automatic and Other Machine Guns, United States Navy.

There are in the Naval Service of the United States a considerable number of 6-millimeter automatic Colt guns, which in general have given good satisfaction. When they have failed it has almost invariably been due to neglect of some piece, or to defective ammunition. When in proper order, with good ammunition, the gun is very efficient.

These guns have the defects common to all belt-loading, single-barrel machine-guns, namely, great accuracy is required in filling the belts; the parts move with great rapidity and the barrel becomes very hot after a short time, rendering it difficult to adjust any derangement which may occur. A single automatic machine-gun should not be relied upon at a critical time, unless well supported by infantry. These guns are light and comparatively inexpensive; they require but few men, and should operate in pairs.

The Bureau of Ordnance has ordered a .30 caliber Colt Automatic to handle the Army cartridge, for test and experiment; also a .30 caliber Gatlin for the same purposes. It is also thought expedient to supply each vessel with a number of automatic guns of small-arm caliber, according to her class, and one hand-working gun. Under such conditions vessels will be in this respect well equipped for any service.

A new type of fully 3-pounder gun has been tried with promising results. Such a gun has a rate of possible fire at 70 per minute as compared with 40 for the semi-automatic gun. It also has the advantage of having four shots in immediate readiness, viz., one in the chamber and three in the loading hopper. This device can also be attached to the 6-pounder semi-automatic gun.

Torpedo Boat Destroyers.

The first of the British "destroyers," the "Havock" and "Hornet," built by Yarrow, of Poplar, England, were tried during the 1894 naval manoeuvres, and stood well a bad knocking about in the Bay of Biscay. The later vessels differ little in design, but some are 20 feet longer; others recently laid down are slightly larger still, and have an increased speed. To-day 24 knots is about the average highest sea speed for the swiftest British "destroyer," and it is rather in trips under favorable conditions and in smooth water that "the great modern advance in speed is attained." Every fraction of a knot means a tremendous and disproportionate exercise of extra horse power. Moreover, bad weather very soon knocks off a good many knots from a small ship.

As a sample "destroyer," we may take the "Boxer," of the British Navy. She is 200 feet long by 19 feet broad, with the usual flattened Thornycraft stern and tumble-down side. A "turtle-back" forecastle makes her look like a large edition of boat of the No. 94 class, which indeed she is in many ways. The gun on top of the conning tower is a 12-pounder Q. F., and on the deck alongside, so mounted so they can fire right ahead, are a couple of 3-pounder Q. F.'s. Two more are carried amidships, and the fifth on a raised platform aft. Just before this last gun are a couple of 18-inch torpedo tubes. Her engines work up to 4,800 horse power, and the speed is about 27 knots in smooth water. Her draught of water is 6 feet 9 inches—a good six inches less than some torpedo boats draw. Her displacement is 250 tons, so she has 16 horse power for every ton. In the old days one horse power to two tons was frequently found in a steamer, and this fact tells how great is the extra energy required to increase the speed by a few knots. As may be imagined, the vessel is a box of engines, and accommodations scanty indeed. The commander's cabin is a small hole full of corners just big enough to swing round the proverbial cat. There is no passage thence to the wardroom; it is necessary to go on deck and descend again. The wardroom is about the same size as that of a "Ninety" class torpedo boat—smaller, if anything—with two bunks on either side and the usual table in the middle. The complement is forty-five officers and men; a commander or lieutenant as captain, one lieutenant or a sub-lieutenant, and engineer, and a gunner. These last three live in the wardroom. They even find their quarters in two tiers under the "turtle-back," where they have to lie pretty close. Fortunately for them, the "Boxer," unlike the earlier "destroyers," carries no bow torpedo tube.

The "Boxer" has two short big funnels, rather wide apart; some "destroyers" have two close together; some three funnels; others, again, have four short uptakes; otherwise the ships are like Chinamen, being impossible to tell "tother from which," and it has been deemed advisable to paint numbers on their bows like torpedo boats. Previously to this any of their crews going ashore had some difficulty in finding their ships again.

The British "destroyers," "Havock," "Charger," "Hasty," "Dragon," "Daring," "Bruiser," "Decoy," "Ardent" are similar vessels, only differing in some minor points. The Birkenhead 30-knot "destroyers," designed, built and engined by Laird Brothers, Birkenhead, England, 1896 and 1897, are of the following dimensions:

Dimensions—213 ft. by 21 ft. 6 in. by 12 ft. 9 in.; speed, 30 knots; engine power, 6,000 horse power; bunker capacity, 90 tons; armament, one 12-pounder quick firing gun, five 6-pounder quick firing guns; two 18-inch torpedo tubes, each mounted on pedestal and racers; complement, 69 officers

and men. Trial on full speed and full power consumption trials, the vessels have carried the full load of 35 tons, to represent the nominal weights, in accordance with the British Admiralty Trial Conditions. Radius of action—The consumption trials of 8 hours duration at 13 knots speed give a radius of action of about 3,500 knots, and the consumption at full power is in all cases within $2\frac{1}{2}$ lbs. per one horse power per hour.

The engines are of Messrs. Laird's noted vertical tri-compound type, and the boilers, of a modified Normand type, are four in number, fired from two stoke holes, one forward of the engines and the other aft, a disposition of machinery which has proved successful in reducing vibration to a minimum, a very necessary thing, as vibration interferes heavily with accurate shooting.

The propellers are all three-bladed and of manganese bronze, but the diameter and pitch are slightly varied. The accommodation provided for officers and men is superior to that provided in torpedo boats, and even that of the most recent 27-knot "destroyers." The commander has a cabin distinct from the wardroom, with a separate entrance.

The pumping and flooding arrangements are very complete and each of the 23 watertight compartments can be readily cleared of water in case of collision or accident. The ventilation throughout is arranged as far as possible by natural means, but whenever necessary patent ventilators are fitted.

The rudder is of novel form, balanced, and of large size to ensure rapidity of manoeuvring ahead and astern.

In the nature of things, "destroyers" in common with all other torpedo craft, are very slightly built; their sides are not so very much thicker than heavy wrapping paper. There is no attempt made to keep shot out; gun shields are the only protection existing in them.

At the Pensacola Navy Yard.

There is in operation at the above yard a floating, balance dry dock which it would pay the reader to inspect if he should happen to be in that neighborhood. It was selected by the U. S. Government during the war with Spain, after an inspection of all the dry docks along the Atlantic seaboard, on account of its first-class construction and the ingenious arrangement of pumps, which enables one man to work engine and gates in such a manner as to empty any single compartment separately.

The dock was built by the Perth Amboy Dry Dock Co., of Perth Amboy, N. J., of which Mr. W. P. Runyon is president, Mr. C. D. Snedeker treasurer and Mr. J. D. Rankin superintendent, the latter being the designer. This company have since built a duplicate of the above dry dock for use at their own ship yard, where they are fully equipped to do all kinds of shipwright work and caulking.

Defence Against Torpedo Craft.

Crinoline Nets, Etc.

In addition to booms and so forth, there are certain other means of defence adopted by ships against torpedo craft. Chief of these is the crinoline net defence. It is objectionable, in that a ship can barely move when thus protected, but it is safe. A few years ago it was not so. Torpedoes were fitted with net-cutters that could shear their way through any net, and many nations—France and Germany in particular—abolished the crinoline altogether. England retained it, but probably only because their torpedo nets is a good drill and evolution. Now, however, a new type of net with a fine mesh, called Gromet, has been adopted, and this is proof against all cutting appliances.

Nets, as most people are aware, are slung upon booms; fixed all around the ship at the water line. These project at right angles flush with the water or nearly so. The nets hanging from them go down to a depth of twenty to twenty-five feet.

Another defence, or at any rate what in the popular idea constitutes a defence, is the searchlight. Much of the fault lies, perhaps, with the name, since searching for boats with the light is a piece of insanity that no captain would be likely to attempt in war time. The use of the searchlight is only to place upon a boat after it has been detected by the naked eye, and even this is dangerous, because the light not only may attract other boats, but its deep shadows afford them a lurking ground under cover of which they can attack with something like impunity. Many officers would prefer to use no light at all.

The name "searchlight" has a good deal to answer for. Rudyard Kipling is one of its victims. In his recent poem, "The Destroyers," the graphic description of the big ships flashing their searchlights seeking for torpedo craft is technically ridiculous. A poet, however, is not to be tied down by facts, even if, as some aver, facts are not the antithesis of poetry. Else Kipling had never called "destroyers" "Choosers of the Slain." It is a grand sounding expression, but happens to be just what "destroyers" are not. Attacking torpedo craft can never differentiate between ship and ship, fishing boats, and even bits of coast have often been fired at by mistake for battle-ships. The real poetry and romance of "destroyers" lie in some of their most prosaic uses.

Means of defence, other than the weirdly picturesque searchlights picket boats, "catchers," and "destroyers," are cruising well out to sea, where the boats cannot find the quarry, and where, even should any chance to, the speed of the ships is too great to give the boats more than a very off chance.

Torpedo Boat Catchers.

The advent of the torpedo boat soon caused men to cast about for an antidote. This was particularly so in England, which, more than any other nation, has to look to be attacked by torpedo boats—"the weapon of the weaker power"—as experts call it. In the year 1885 the "Swift" torpedo catcher was built, but as she was only 150 feet long, she proved far too small for the work required, and has long since been turned into a torpedo boat, now figuring as No. 81. She carries six three-pounder guns and a crew of twenty-five men. The British "Scout" and "Fearless," of 1,580 tons, soon followed, but these turned out too slow and too heavily armed for the work required, and in the "Rattlesnake," launched in 1886, the British Navy had the first genuine "catcher." This ship of 550 tons, carrying one four-inch and six three-pounder Hotchkiss quick-firing guns. The builders, Messrs. Laird, of Birkenhead, though the money was subsequently refunded, were fined £1,000 for making her engines too heavy, and it is worthy of note that the "Rattlesnake" is the only ship of her class that has never broken down in any way. Her actual speed at sea is a little under 18 knots, and she has been known to exceed that at a pinch. The "Grasshopper," "Spider" and "Sandfly," sister ships of the British Navy, are not able to make much over 13.5 knots except on paper. Indeed, none of the speeds given in the tabulated lists of warships are reliable.

The speeds were made under the most favorable conditions, with picked coal, picked stokers, and in smooth water. The more rough and ready conditions at sea reduce a ship's speed by two to four knots; the fouling of the bottom by seaweed and barnacles and the gradual ageing of the machinery compel a still greater reduction in time. In 1888 the British "Sharpshooter" was laid down. The "Rattlesnake" class suffered from seas breaking on the low forecastle. The "Sandfly" nearly foundered in the Bay of Biscay from this cause. A better boat was desired. The "Sharpshooter," 735 tons, was the result, and twenty-seven vessels of this class have been built, the displacement gradually rising to 1,000 tons.

The "Seagull," as she was in 1894, may be taken as a representative vessel. She is 230 feet long and of 735 tons displacement. The forecastle forward is some 13 feet out of water; abaft the forecastle her deck is about 6 feet above the water line. Two three-pounder quick-firing guns are carried in the crew's quarters in the raised forecastle, two more amidships on deck. There is a fixed torpedo tube in the bow, while a 4.7 quick-fire gun is mounted on top of the forecastle. A second 4.7 is carried in the stern. There are two funnels, wide apart, and just abaft the after funnel are two pairs of torpedo tubes, 18-inch tubes on the port and 14-inch tubes on the starboard side. A spiral staircase up through a ventilating cowl leads to a fore and aft bridge, so as to render it less difficult to reach the fore bridge in bad weather.

In the "catchers" of the "Rattlesnake" class it is often an extremely arduous task to get forward in a gale, the "well" amidships being generally full of rushing water. The "Seagull" class are not so "wet." They are terribly lively boats, however, the motion being, if anything, worse than that in a torpedo boat, and in none of these craft can life be called a bed of roses. The complement, all told, is about ninety men. The officers are a commander or lieutenant, commander in command, two sub-lieutenants and a gunner. The non-executive officers include a doctor and two engineers. Cabin accommodation is rather limited. The captain's cabin is fairly roomy, the wardroom as large as can be expected, but the officers' cabins are very diminutive, being but some six feet square. As these are one too few, one officer has to sling a cot or hammock in the wardroom, and the gangway outside has to do as a bathroom.

In common with all small craft, ventilation at sea in the "Seagull" is existent only in fine weather. Her actual sea speed is little over 15 knots. The speeds of all this class fall short of the anticipated result by several knots, and they have been much blamed on that account. They are splendid boats, however, and though liable to be easily sunk in action by a cruiser, would be well able to destroy torpedo boats or "destroyers" that might venture out in bad weather, and they can keep the sea for about a week without recoaling, if needs be. The "Seagull" class, carrying as they do several torpedo tubes, might in a fleet action await an opportunity to use their torpedoes under cover of the battle smoke. They have had that role assigned to them in manoeuvres.

In actual warfare, the "Lynch" and "Condell," of this class, torpedoed and sunk the Chilian ironclad "Blanco Encalada," in April, 1891, with little damage to themselves, early one morning, while it was yet almost dark. A day or so later they were beaten off by an armed transport, so they appear to be more dangerous as torpedo craft than gunboats. In the Chino-Japanese War, the "Kwang Yih," Chinese torpedo gunboat, with an actual speed of 12 knots, attempted to torpedo two swift Japanese cruisers off Baker Island, in the day time, but was soon destroyed.

Their comparative failure led, however, to the evolution of the "destroyer."



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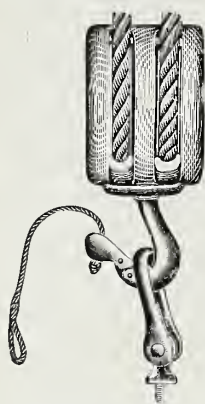
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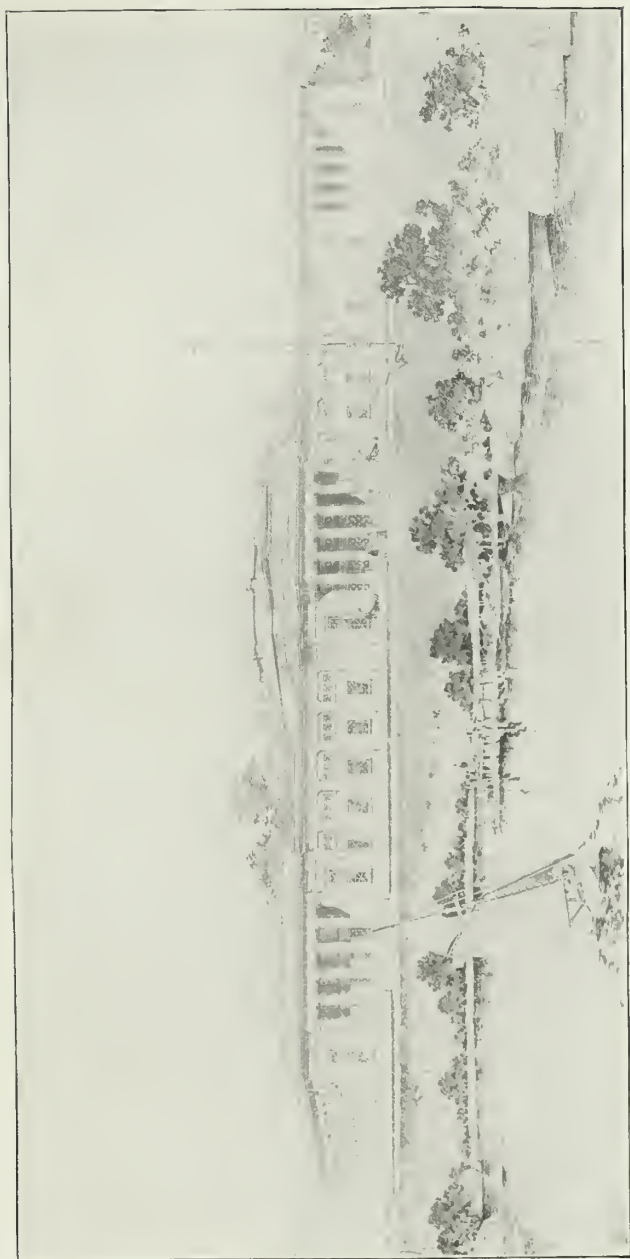
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The Torpedo in Peace and War.*

Torpedo craft are divided into two broad classes:

I. Torpedo boats.

II. Torpedo catchers and destroyers of torpedo boats.

But there are not wanting indications that is the last that are most likely to act as torpedo boats in war time. Indeed, most of the ironclads sent to the bottom by torpedoes have gone there by the aid of "catchers."

New as the torpedo boat is held to be, it is the weapon rather than the idea that is novel. Every reader of "Westward Ho!" must remember the galleys that attacked the ship *Amyas Leigh* off La Guayra, and every student of history knows of the "praams" of the great French war. To all intents and purposes these were the ancestors of the present torpedo boat, in that they were craft weak in themselves and unable to risk a stand-up fight.

They were designed to harass the enemy. That is exactly the duty of the modern torpedo boat, and the blowing up of a battleship is an incident rather than the main object in a torpedo boat's career. The blowing up of the battleship may be a great and decided gain, but if the fact that torpedo boats are in a certain place prevent battleships from going past or near to for fear of what may happen, then the torpedo boat will have attained its object, though it has never left the harbor.

This "menace" of torpedo boats is now largely recognized by strategical writers who know something of the torpedo boats' weak points. In actual history we have more than one instance of its effectiveness, notably after the battle of Talu. In that famous sea fight the Chinese had their two indifferent torpedo boats, one of which got quite close to the Japanese "*Saikio-Maru*" and fired no less than three torpedoes, none of which hit.

In fine, they were very indifferent craft, bad in speed, bad in endurance, bad in their crews. All this the Japanese must have known, yet at nightfall, after the battle, they feared to attack the badly disabled and retreating Chinese fleet, because these boats were with it. Now, no one could accuse the Japanese sailors of timidity or nervousness, and, flushed with victory, they would have been the last people in the world to hold back for any but a very real and valid reason. Their admiral calculated his chances, calculated that on the chance of destroying four Chinese ships he would have to risk the loss of four or five of his best vessels by torpedoes, and, like a wise man, he forbore to run such a risk.

As regards the torpedo itself, here again we have no really new weapon. The "petard" was known in the days of Shakespeare. We can trace its slow upward course from the mine lit by a fuse to the floating horror that ex-

*"The Torpedo in Peace and War," by Fred. T. Jane, London, 1893.

ploded on contact; from the infernal machine that had to be screwed to the doomed vessel—vide the tale of the torpedoist who in the Crimean War screwed a torpedo to his own flagship under the impression that she was a Russian vessel—to the spar torpedo of a few years since.

This last device consisted in carrying the explosive at the end of a long spar projecting from the bow of the boat. Explosion was secured by impact. It was the method resorted to in the American Civil War, 1860-64, when the *Albemarle* and several other vessels were sunk by such means. In the Chino-Japanese War a star torpedo was used to destroy the wrecked cruiser "Yang Wei."

For a short time in the "sixties" a towing torpedo, called the "Harvey," had a brief period of popularity, but the invention of the "Whitehead" fish torpedo in 1868 almost immediately relegated all other methods to the obscurity of the past. Of late, indeed, we have heard much of such devices as the "Brennan" and "Sims-Edison" torpedoes, machines steerable from ship or shore by means of long wires trailing out astern, and the "Brennan" we use for harbor defense, but the actual and practical value of both is much doubted. The weapon of to-day is the "Whitehead" or fish torpedo.

The "Whitehead" has been steadily perfected since its invention. It may be best described as a cigar-shaped steel projectile or submarine boat. It is divided into compartments, the head, which contains 200 pounds of gun-cotton, the mysterious "balance chamber," and the appurtenances thereof, all of which go to keep the weapon steady on its course, and finally, the little compressed air engine that drives the tail screw.

The present "Whitehead" has an effective range of about 500 yards, and a speed at first of over 30 knots. It will travel 800 or 900 yards, but at such a range hits must of necessity be pure luck. The range and speed are, however, almost daily subject to improvement. Forty knots is hoped for in speed, and as to range that is very likely to be considerably increased as time goes on. The earliest "Whitehead," of about the year 1870, had a speed of only 8 knots, the maximum distance it could travel was about 400 yards, and its accuracy was in no way to be compared to that of the present model. Altogether, there are no less than twenty-one types of torpedoes in the English naval service, but many, of course, are quite out of date, and of the others they have only infinitesimal differences between them. Practically there are but two sorts, the 14-inch and the 18-inch. Of these, that in most general use is the 14-inch R. G. E. Mark VIII., of which considerably over a thousand are in the English service, chiefly on shipboard. This torpedo is 15 feet long, carries an explosive charge of 65 pounds of gun-cotton, has a speed of 26 knots and a range of 600 yards. A Mark IX., similar in most respects but with heavier charges and three-bladed propellers, are to be found in torpedo boats.

The 18-inch torpedo averages nearly 17 feet in length, has a charge close upon 200 pounds of gun-cotton, a speed of 30 knots, and a range of 800 to 1,000 yards. None of these were made before 1892.

France uses the "Whitehead" torpedo, and has a factory for them at Toulon, where they are turned out at the rate of two a week. They have

about six sorts, 18-inch, 15-inch and 14-inch, long and short of each caliber. Italy uses the "Whitehead" and a sort of "made-in-Germany" edition of it, called the "Schwartz-Kopff." The Chinese in the Chino-Japanese War used, or rather tried to use, this torpedo. Spain also employs it. The Russian torpedo is also a form of the "Whitehead," but has a 300-pound explosive charge.

The United States Navy uses the "Whitehead," but its real torpedo is the "Howell." This is a very blunt-headed machine, rather like a porpoise to look at. Instead of compressed air it depends for its motive power upon a heavy fly-wheel that makes 10,000 revolutions a minute. The method is equivalent to the toy engines that are made to run by a wheel and some string. This torpedo is said to have given excellent results. The latest pattern is a 17-inch, 14½ feet long, speed 33.30 knots, and maximum range 800 yards. On trial, 332 hits were made out of 345 attempts, but the target was a large one, and hits in practice are always comparatively easy, as the range is known—in action not.

The cost of a torpedo in England is from £500 to £600. The British ones are manufactured at Woolwich, and by Whitehead at his works at Fiume, Austria, or at Portland, England.

Stated in detail, the parts of a torpedo are as follows:

(a) The explosive head (war head). This is only fitted when the torpedo is to be used in earnest. For practice, a collapsible head is fitted. The torpedo explodes by contact, a detonator firing the charge.

(b) The air chamber, full of compressed air, equivalent to the boilers of a steamer.

(c) The balance chamber. This regulates the depth under water at which the torpedo will run.

(d) The engine room.

(e) A buoyancy chamber.

(f) A tail with rudders. A torpedo has lately been experimented with in the Germany Navy whereby these rudders are made to automatically steer the torpedo on the aimed course, and so counteract deflection by tide or current. Beyond the tail come the propellers.

In addition to these there are great many minor appliances of considerable importance. These include mechanism to make the torpedo rise to the surface or else sink altogether when it has run its course, and a variety of valves for different purposes.

Torpedoes are fired from a species of gun, torpedo tube. Cordite is now nearly always the impulse power, but formerly both powder and compressed air were employed. In any case, the result is the same, the torpedo being ejected into the water in the required direction, after that it takes the depth for which it has been set and supplies its own motive power. These tubes when above water can be trained, except in the case of "fixed tubes," at bow and stern; but it is only in a big ship that they would be trained in action, if there. It is, moreover, highly improbable whether a big ship would attempt to use above-water tubes in action, the risk of an exploding shell sending off the torpedo being too great.

In torpedo craft the tubes are loaded and trained in harbor. The boat manoeuvres so that the tubes bear when she goes into action. A device, technically known as a "director," is fitted on the top of the tube. When the ship to be hit comes into line with the sights of the director the trigger or lanyard is pulled and the torpedo rattles out, dives and continues its submarine course upon "the target." Bubbles and splashes on the surface some way astern of where the torpedo actually is mark its course.

Submerged tubes, save that they are much larger, do not differ materially from the above-water ones. They have valves to prevent ingress of water, and in the case of British tubes, a bar to keep the torpedo from being deflected or hit by the ship. The Elswick tube, concerning which there has been so much talk of late, has a second tube inside the first, and this tube is projected from the side of the ship, the torpedo passing into the water through it. It is inferior in some ways to the British Navy's tube, but considerably superior to the average foreign submerged one, which is often a very erratic weapon indeed. The Japanese ironclads "Yashima" and "Fuji" and the Norwegian "Harald Haarfagre" and "Tordens Kjoed" are the only vessels as yet armed with the "Elswick" tube.



Submarine Mines, Etc.

Mines may be broadly divided into two kinds—those that are exploded at will and those that explode themselves when any ship touches them. The former, which are already laid in nearly every important harbor in the world, are worked upon a system with which most people are now familiar. On the field of a camera obscura the radius of explosion is marked. When a ship passes over this spot the mine is electrically exploded by pressing a firing key. In theory such mines should be absolutely certain in their effects, but, save, perhaps, for the case of the "Maine," there is as yet no record of success.

At Manila, two observation mines are said to have been exploded on either side just ahead of the Olympia. It is, of course, presumable that so few mines existed that the ship just happened to pass across a safe channel beyond the radius of damage. It is equally possible that a third mine immediately under the ship failed to explode. But it is far more likely that excitement on part of the operator led to a premature explosion, and this may be looked for frequently in actual war. No matter how theoretically infallible the machine may be, the controlling personal element is always subject to error. There is, of course, another possibility. These mines may be mythical, like so many incidents of the Hispano-American conflict.

To the recent "Maine" disaster, which is generally attributed to a mine, it is unnecessary to refer at length. The ironclad lay in Havana harbor in the evening. Suddenly and without warning there was a violent explosion that literally tore the fore part of the ship to pieces. A second explosion followed, the ship burst into flames, and amid a salvo of exploding magazines and bursting boilers she went to the bottom with the greater part of her crew. Who did the deed is, and probably ever will be, a matter of uncertainty. It is quite possible that it was a pure accident, though the evidence is against it.

If the mine was an observation mine it could hardly have been an accidental affair, but there is nothing absolutely improbable in the Spaniards having electro-contact mines moored in the harbor. One could hardly credit the idea were any other nation, unless it might be the Chinese, concerned, but the Spaniards are notoriously careless people. It is conceivable enough that such a mine should break loose. Incidents of that sort have been. Then, if it struck the ship, disaster would follow. But when all is said and done, this is giving the Spaniards the benefit of a very wild hypothesis; the fairly evident proof of the mine's having exploded directly under the ship points as clearly as may be to an observation mine fired with deliberate intent.

The chief concern of the navy with mines is their destruction. This is brought about in various ways, the principal being the explosion of other mines—countermines—on the hostile mine field. Other methods are creeping or groping for the cables with grapnels. One found, the cable can be hauled up and cut, thus rendering the mine useless.

Since, however, it may be assumed that any enemy would protect his mine field with guns, in which case creeping would be practically impossible, countermining may be taken as the general answer. Under fire—this is done by a tug or other steamer towing a countermining launch over the supposed mine field. The mines are dropped, and directly the boat gets beyond the radius of upheaval, electrically exploded. The shock of the explosion sets off all mines within its radius, and the channel is then clear.

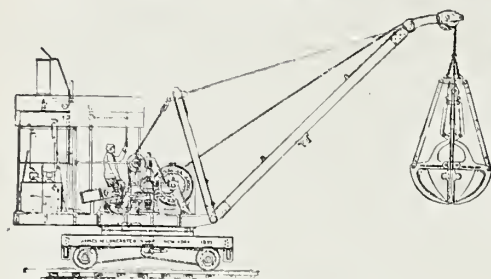
In war time these countermines might, and very possibly would, be exploded at the ends of booms projecting from an ironclad's bow. A still more general probability is, however, that ships would leave a place known to be mined severely alone, unless it were absolutely necessary, or else possible to silence the guns. Well-placed guns are practically safe against warships, except by an expenditure of far more ammunition than they can afford. Unless a gun is actually hit the harm done is very slight. The bombardments of Santiago by the American fleet did very little harm in comparison to the energy expended; that is to say, every fort seemed able to be "totally destroyed," yet ready to forget it again the next minute.

In close connection with mine fields are booms. These may be intended to keep out torpedo boats, or possibly larger ships. The main idea is always the same—a floating obstruction with hawsers stretched above and below the water, as well as wire to foul the screws of the charging ship. A good many booms have been experimented with at Portsmouth, England, and elsewhere, and till quite recently none able to keep out torpedo boats had been devised. With her bow fitted with a wooden angle, a torpedo boat going at full speed has generally been able to leap the obstruction and luck has usually attended her in the matter of escaping the various wires, hooks and other devices designed to either capsize her, foul her screws, or make holes in her bottom. Experimental trips of this sort are not without danger.

The latest form of boom adopted is more or less proof against torpedo boats, and what can be done in peace could not necessarily be accomplished in war. There is a limit in experiments to the amount of "devilish devices" that can be fitted; in war there would be none.

The boom that could keep out a ship that meant to get through has yet to be invented. The energy of a charging ironclad is very nearly irresistible. In theory the charger would be likely to hurt herself considerably, but experiments do not altogether bear this out. Some years ago the British torpedo ram "Polyphemus" charged a boom in Bantry Bay, and simply cut it apart as though she were a knife, no visible resistance being offered and no harm whatever done to the ship.

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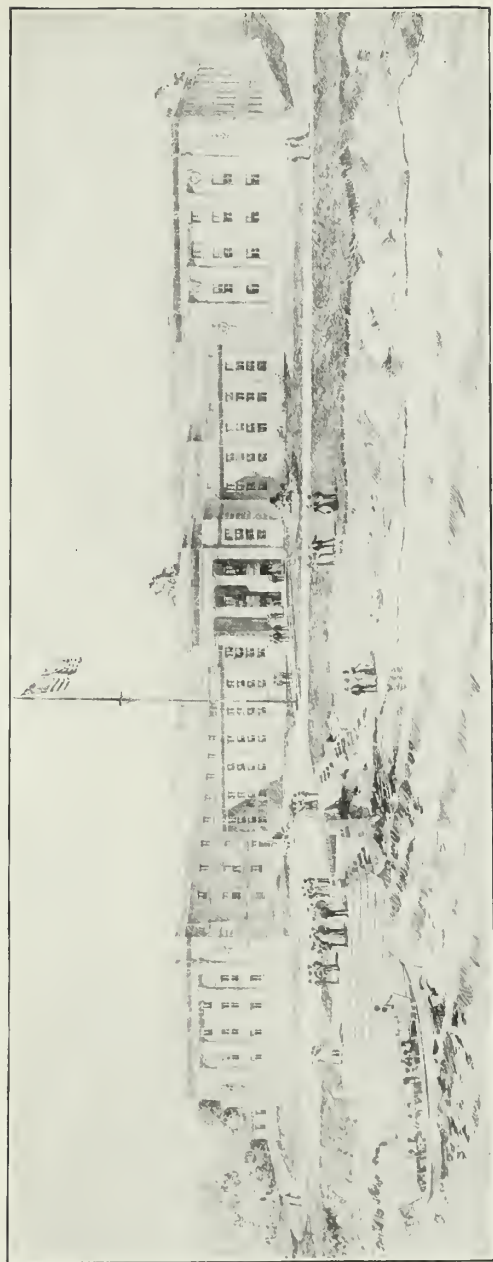
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Area of Buildings Occupied.

	sq. ft.
North Gun Shop	24,103
“ “ “ Galleries	9,837
“ “ “ Shed	6,444
South Gun Shop and Breech Mechanism Shop.....	51,948
Erecting Shop	10,561
“ “ Galleries	3,348
East Gun Carriage Shop.....	25,971
West “ “ “	25,971
South “ “ “	7,396
Foundry	15,706
“ Shed	8,964
Forge Shop	15,340
Pattern Shop (2 stories).....	38,008
Cartridge Case Factory	18,356
Secondary Mount Shop.....	15,248
Tool Shop	5,032
Shell House	8,379
Electric Light Station.....	4,550
Boiler House	4,000
Locomotive House	1,500
Gun Shed	16,098
Laboratory	2,500
Coppersmith Shop	5,200
Store No. 10.....	18,211
“ No. 2	30,225
Ordnance Office	7,200
Total	378,597

TABLE

Showing Nature, Calibre, Weight, Total Length, Weight of Service Charge, Weight of Projectile, Muzzle Velocity, Muzzle Energy, Perforation of Wrought Iron at Muzzle of U. S. Naval Guns.

NATURE OF GUN.			Calibre.	Weight.	Total Length.	Weight of Service Charge (Not smokeless powder.)	Weight of Projectile.	Muzzle Velocity. (Service.)	Muzzle Energy.	Perforation of Wrought Iron at or Muzzle.
			in.	tons.		lbs.	lbs.	ft sec	ft. tons	in.
4-inch	B. L. R.	Mark I	4	1 5	13 7	12 to 14	33	2000	915	10 1
4 "	R. F.*	Gun	4	1 5	13 7	12 to 14	33	2000	915	10 1
5 "	B. L. R.	Mark I	5	2 8	13 5	26 to 29	60	2000	1,660	12.
5 "	R. F.*	Gun	5	3.1	17.4	28 to 30	50	2300	1,834	13.
6 "	B. L. R.	Mark I	6	4.8	15.8	50	100	2000	2,773	} 14.
6 "	B. L. R.	Mark II	6	4 9	16 1	45 to 48	100	2000	2,773	
6 "	B. L. R.	Mark III, of 30 Cal.	6	4 8	16 3	44 to 47	100	2000	2,773	
6 "	B. L. R.	Mark III, of 35 Cal.	6	5.2	18.8	44 to 47	100	2080	2,990	14 8
6 "	B. L. R.	Mark III, of 40 Cal.	6	6 0	21.3	44 to 47	100	2150	3,204	15.6
8 "	B. L. R.	Mark I	8	{ 12 3 12 9 }	21 5	105 to 115	250	2000	6,932	19.4
8 "	B. L. R.	Mark II	8	13.0	21 5	105 to 115	250	2000	6,932	19.4
8 "	B. L. R.	Mark III, of 35 Cal.	8	13 1	25 4	105 to 115	250	2080	7,498	20 6
8 "	B. L. R.	Mark III, of 40 Cal.	8	15 2	28 7	105 to 115	250	2150	8,011	21 6
10 "	B. L. R.	Mark I, of 30 Cal.	10	25.7	27 4	225 to 240	500	2000	13,864	24
10 "	B. L. R.	Mark I, of 35 Cal.	10	{ 27 1 28 2 }	30.5	225 to 240	500	2060	14,709	25.8
10 "	B. L. R.	Mark II, of 30 Cal.	10	25 1	27.4	225 to 240	500	2000	13,864	24.
10 "	B. L. R.	Mark II, of 35 Cal.	10	27 6	31.2	225 to 240	500	2100	15,285	26 6
12 "	B. L. R.	Mark I	12	45 2	36.8	425	850	2100	25 985	31 5
13 "	B. L. R.	Mark I	13	60 5	40 0	550	1100	2100	33 627	34 6

Penetration into Nickle Steel, not face-hardened, of High Power Guns of 50 Calibres Length.

(SHELLS NOT CAPPED.)

Gun.	Weight of Shell.	Muzzle Vel.	Pen. at Muzzle.
3-inch	14 lbs.	3000	9 in. 4
4 "	33 "	3000	12 " 8.
5 "	60 "	3000	15 " 4.
6 "	100 "	3000	18 " 3.

*Weight of Shell for 40 Calibre R. F. Gun, 50 lbs.

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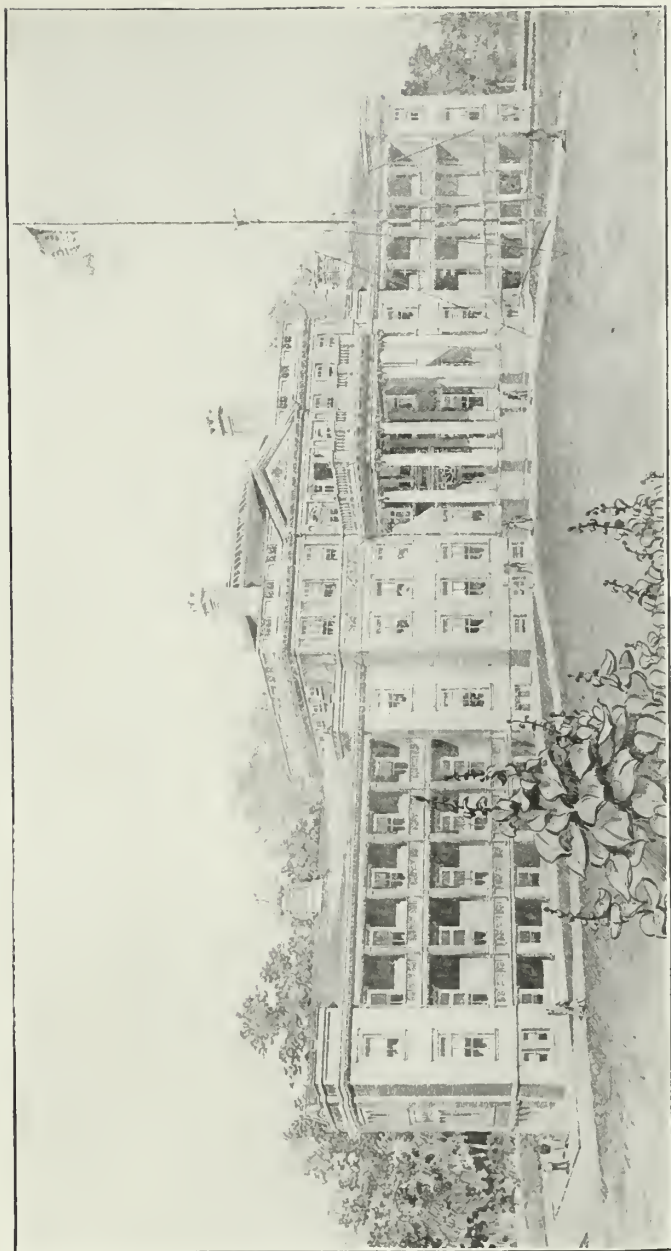


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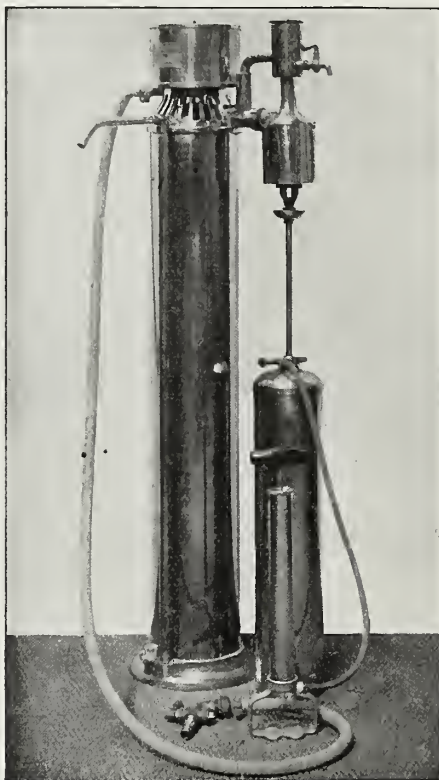


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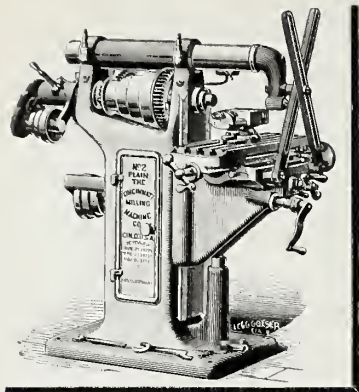
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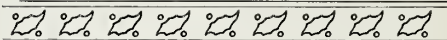
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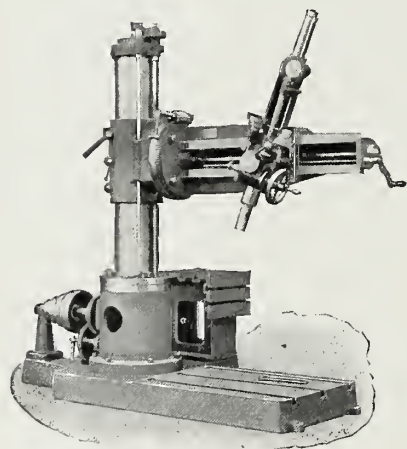
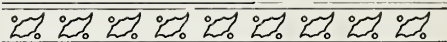
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Nickel was first used for this purpose about ten years ago, since which time it has been generally adopted for first-class armor, except for the Navy of Great Britain, but it is lately reported that the English government has decided to adopt nickel steel armor, which will make the use of this material almost universal.

The nickel steel ingots for the manufacture of armor plates are made by the open-hearth process. The Carnegie Steel Company uses basic open-hearth steel for this purpose. The weight of the ingot as cast is required to be at least double the weight of the finished plate, or plates, to be made from the ingot, the principal discard being from the upper end of the ingot as cast. The ingot is forged down to a thickness of two inches or three inches greater than the thickness of the finished plate. This forging is done by a hydraulic forging press of about thirteen thousand tons capacity. The ingot, while being forged, is suspended from a traveling crane, and is handled by means of a long porter bar. After this preliminary forging, the plate is carbonized on the face by a process consisting of building up, in a special furnace for the purpose, a structure of fire-brick to contain the plate and the carbonizing mixture. This mixture, which consists of animal and vegetable charcoal, ground fine, is in contact with the face of the plate to be carbonized. A bed of this material a foot or more in thickness is generally used.

The plate in the carbonizing furnace is gradually brought up to the proper temperature, and maintained at this temperature for ten days or two weeks, according to the thickness of the plate, thicker plates requiring a longer time than thinner ones.

After allowing the furnace to gradually cool down, the plate is removed and chemical analyses for carbon are made from the face, and from different depths below the surface, for the purpose of determining whether the carbonization has been sufficient to enable the plate to take a proper temper on the face.

After the carbonization the plate is reheated for the final forging under the hydraulic press, when it is forged down to its final thickness. The object of this reforging, as it is called, is to restore to the body of the plate a proper forged character, much of the effect of the former forging having been undone by the long-continual high temperature of carbonization, which tends

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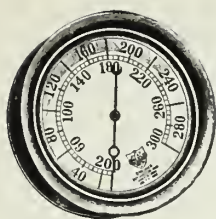
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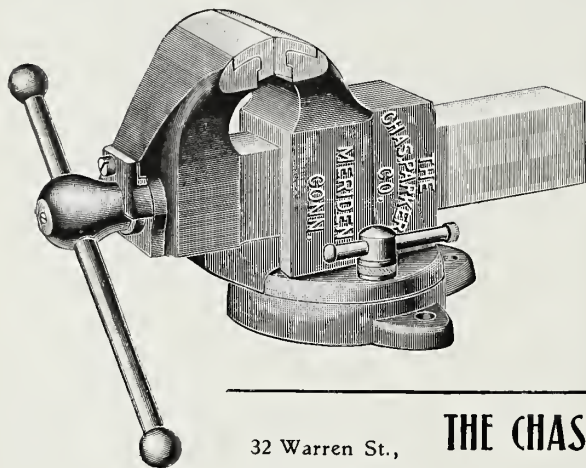
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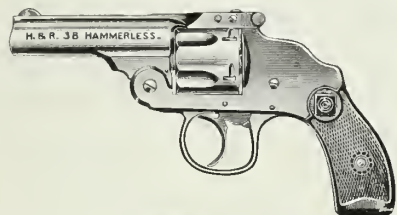
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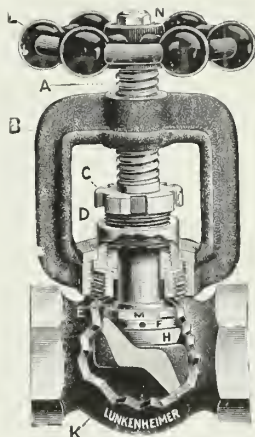
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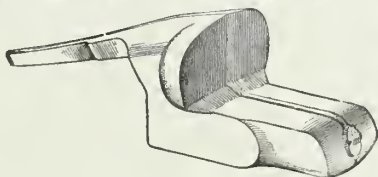


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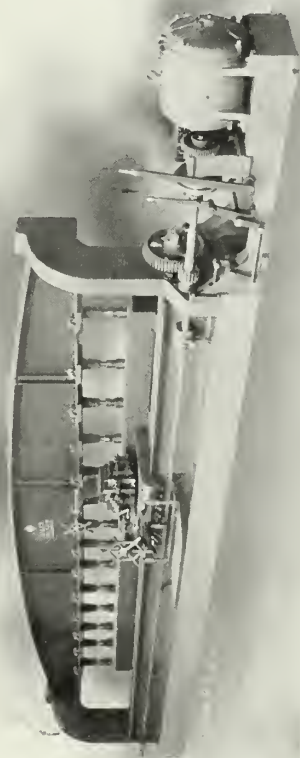
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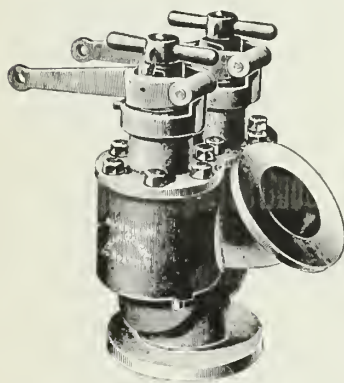
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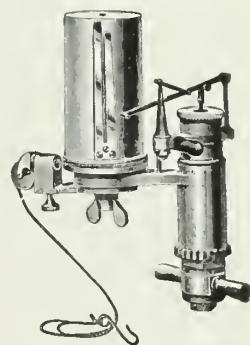
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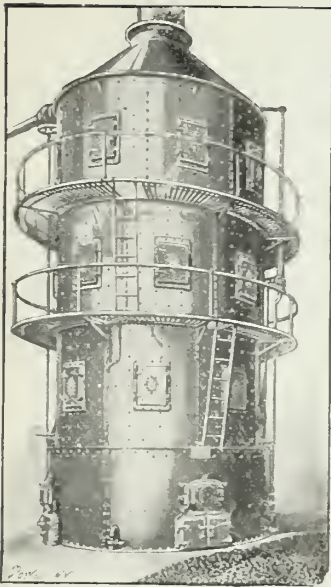
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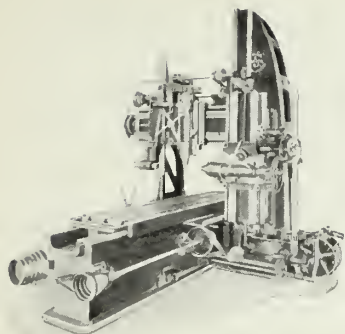


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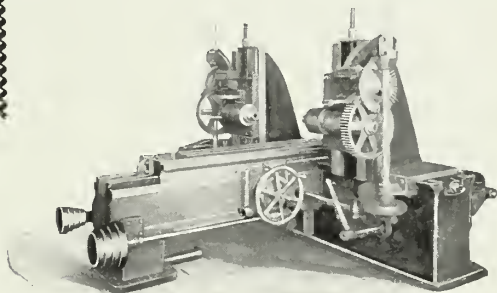
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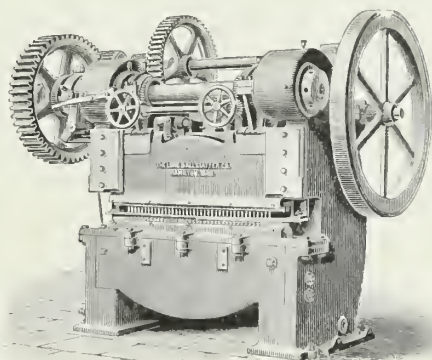
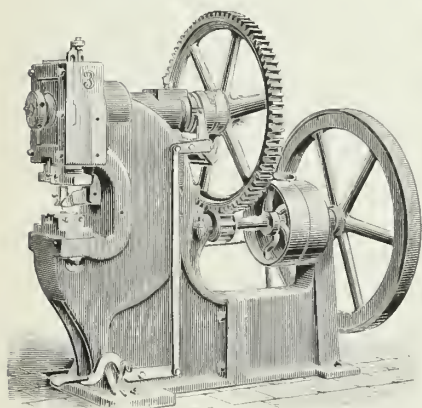
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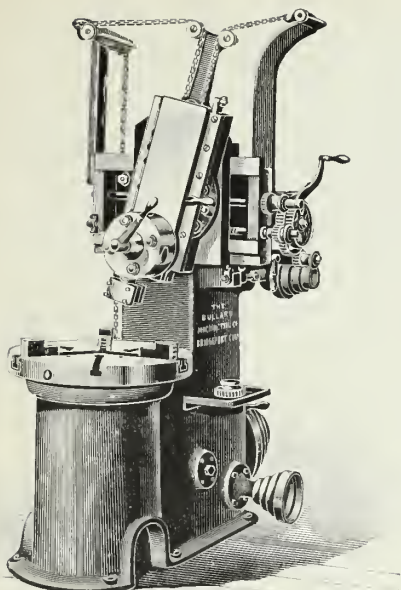
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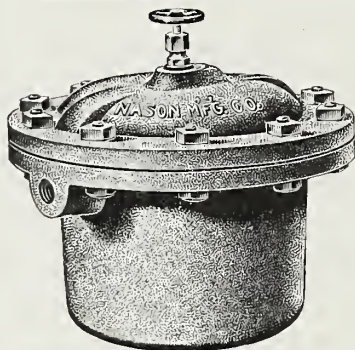
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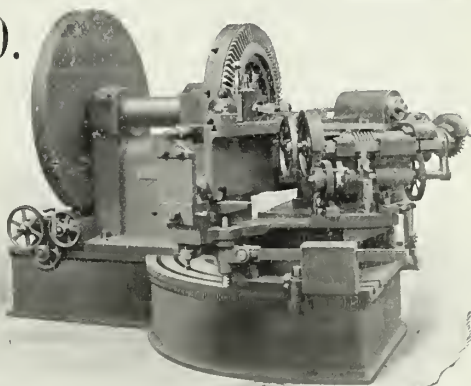
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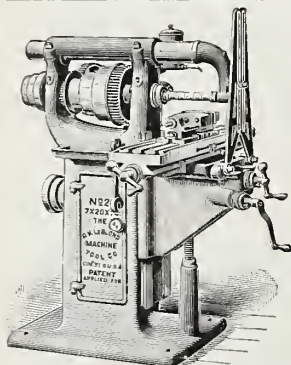
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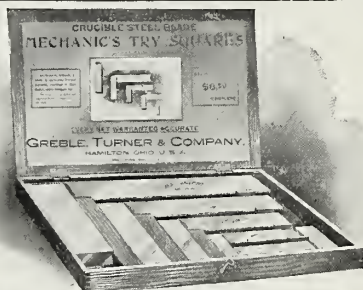
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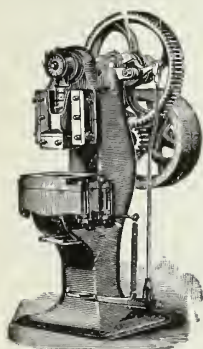
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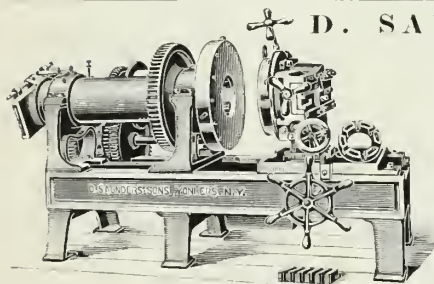


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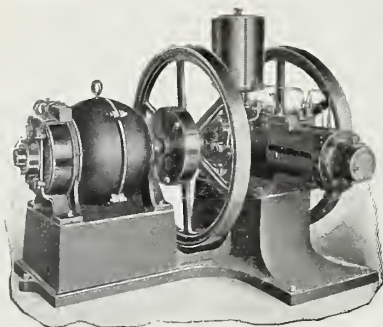
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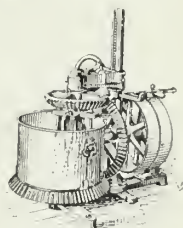
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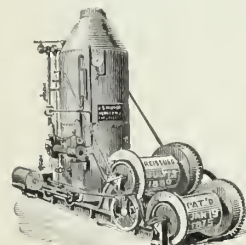
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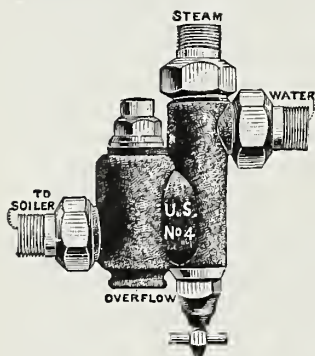
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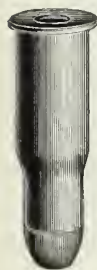


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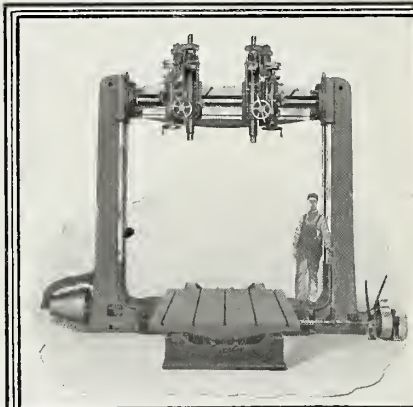
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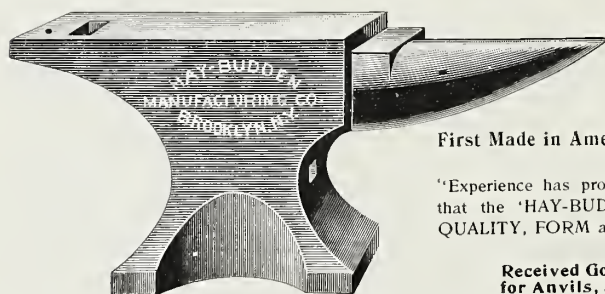
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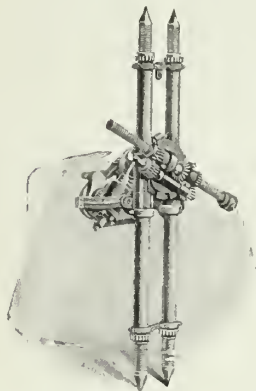
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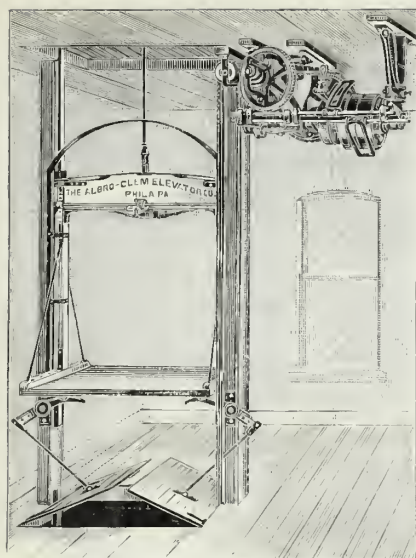
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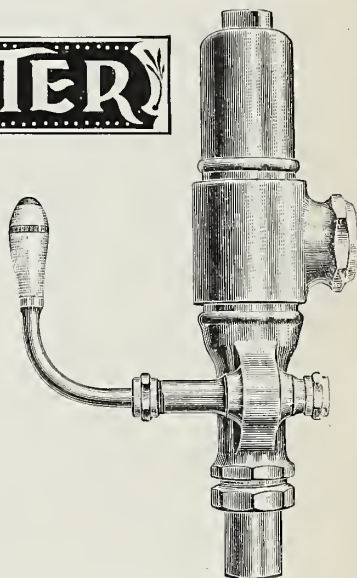
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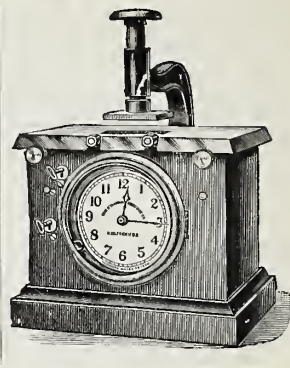


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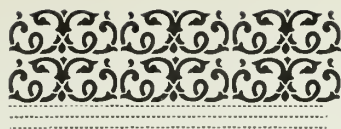
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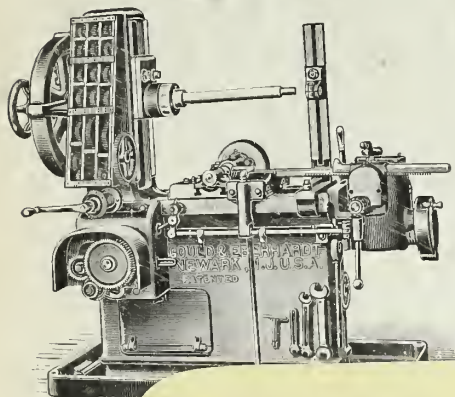
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